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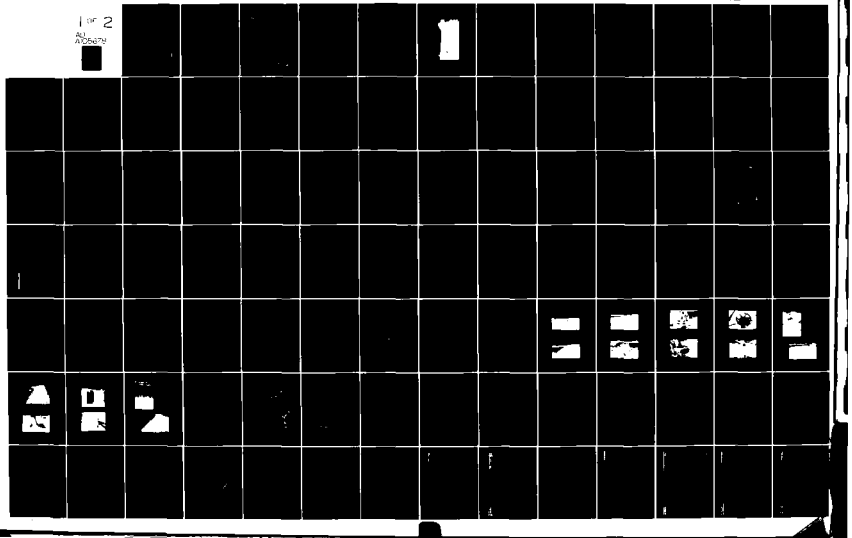

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MISSISSIPPI - SALT - QUINCY RIVER BASIN

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HENRY SEVER DAM

KNOX COUNTY, MISSOURI

MO 10110

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

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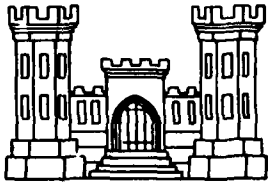

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dam Safety, Lake, Dam Inspection, Private Dams

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

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DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 NORTH 12TH STREET
ST. LOUIS, MISSOURI 63101

IN REPLY REFER TO

SUBJECT: Henry Sever Dam (Mo. 10110), Phase I Inspection Report

This report presents the results of field inspection and evaluation of Henry Sever Dam (Mo. 10110).

It was prepared under the National Program of Inspection of Non-Federal Dams.

This dam has been classified as unsafe, non-emergency by the St. Louis District as a result of the application of the following criteria:

1) Spillway will not pass 50 percent of the Probable Maximum Flood.

2) Overtopping could result in dam failure.

3) Dam failure significantly increases the hazard to loss of life downstream.

SUBMITTED BY: SIGNED
Chief, Engineering Division

12 MAR 1979
(Date)

APPROVED BY: SIGNED
Colonel, CE, District Engineer

12 MAR 1979
(Date)

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Henry Sever Dam, Missouri Inv. No. 10110
State Located:	Missouri
County Located:	Knox
Stream:	Myers Branch of the South Fabius River
Date of Inspection:	September 27 and October 4, 1978

Henry Sever Dam No. Mo. 10110 was inspected using the "Recommended Guidelines for Safety Inspection of Dams". These guidelines were developed by the Chief of Engineers, U.S. Army, Washington, D.C., with the help of Federal and state agencies, professional engineering organizations, and private engineers. The resulting guidelines are considered to represent a consensus of the engineering profession.

Based on the criteria in the guidelines, the dam is in the high hazard potential classification, which means that loss of life and appreciable property loss could occur in the event of failure of the dam. Two farmhouses with associated farm buildings, five trailer camping pads, one improved road crossing, one state highway, and the town of Newark, Missouri would be subjected to flooding, with possible damage and/or destruction, and possible loss of life. Henry Sever Dam is in the intermediate size classification since it is more than 40 feet high, but less than 100 feet high, and impounds more than 1,000 acre-feet, but less than 50,000 acre-feet of water.

Our inspection and evaluation indicates that the spillway of Henry Sever Dam does not meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. Henry Sever Dam is an intermediate size dam with a high hazard potential required by the guidelines to pass the Probable Maximum Flood without overtopping. It was determined that the spillway will pass 34 percent of the Probable Maximum Flood without overtopping the dam. Our evaluation indicates that the spillway will pass the 100-year flood; that is, a flood having a 1 percent chance of being equalled or exceeded during any given year.

The Probable Maximum Flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in the region.

Other deficiencies noted by the inspection team were a need for an annual inspection by a qualified professional engineer; lack of a maintenance schedule; embankment sloughing on the upstream slope; and vegetative growth in the approach and discharge channels of the service spillway and the outlet works discharge channel. The lack of stability and seepage analysis on record is also a deficiency that should be corrected.

It is recommended that the owner take action to correct or control the deficiencies described above.

HENRY SEVER DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Henry Sever Dam, I.D. No. 10110

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

HENRY SEVER DAM, Missouri Inv. No. 10110

SECTION 1: PROJECT INFORMATION

1.1 General

a. Authority

The Dam Inspection Act, Public Law 92-367 of August, 1972, authorizes the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspections. Inspection for the Henry Sever Dam was carried out under Contract DACW 43-78-C-0160 to the Department of the Army, St. Louis District, Corps of Engineers, by the engineering firms of Consoer, Townsend & Associated Ltd., and Engineering Consultants, Inc. (A Joint Venture), of St. Louis, Missouri.

b. Purpose of Inspection

The visual inspection of the Henry Sever Dam was made on September 27 and October 4, 1978. The purpose of the inspection was to make a general assessment as to the structural integrity and operational adequacy of the dam embankment and its appurtenant structures.

c. Scope of Report

This report summarizes available pertinent data relating to the project; presents a summary of visual observations made during the field inspection; presents an evaluation of hydrologic and hydraulic conditions at the site; presents an evaluation as to the structural adequacy of the various project features; and assesses the general condition of the dam with respect to safety.

It should be noted that reference in this report to left or right abutments is as viewed looking downstream. Where left abutment or left side of the dam is used in this report, this also refers to east abutment or side, and right to the west abutment or side.

d. Evaluation Criteria

Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, in "Recommended Guidelines for Safety Inspection of Dams", Appendix D. These guidelines were developed with the help of several Federal agencies and many state agencies, professional engineering organizations, and private engineers.

1.2 Description of Project

a. Description of Dam and Appurtenances

The dam embankment is a homogeneous earthfill structure. The crest of the embankment has a width of 15 feet and a length of approximately 1,160 feet. The crest elevation is set at 688.0 feet above MSL, and the maximum height of the embankment is 43 feet above the minimum streambed elevation along the centerline of the dam.

The upstream slope of the embankment section is constructed with a 1V to 3H slope for the top 10 vertical feet, a 10-foot wide berm at elevation 678.0, and a 1V to 3H slope from the berm to the ground surface. The downstream embankment slope is 1V to 2-1/2H from the crest to the toe.

A 12-inch thick layer of dumped rock riprap with a 3-inch thick layer of gravel bedding was placed on the upstream slope from elevation 678.0 to 687.0. The rock used for riprap was limestone blocks up to 2 feet in diameter, with the majority of the blocks between 1 and 2 feet in diameter. The crest and downstream slope is provided with a heavy vegetative cover.

Bedrock at the site and within the vicinity is composed of Mississippian age limestones. No rock crops out over the site. The soil in the vicinity of the dam is likely a Lindley silt loam which is glacial in origin.

A cut-off trench was excavated along the axis of the dam with side slopes of 1H to 1V, and a base width of 10 feet. In the channel section, the trench penetrated the foundation materials for a minimum depth of 10 feet, and in

the abutments the trench ranged in depth from less than 1 foot up to 8 feet.

There are two spillways in the Henry Sever Dam. The service spillway is located at the southwest end of the dam. This spillway is a concrete chute type spillway with a U-shape concrete drop inlet. The spillway crest is uncontrolled, and has a total crest length of 30 feet. A stilling basin is connected at the end of the spillway chute. The emergency spillway is a cut section located at the northeast abutment. Spillway cross-section along the crest is trapezoidal, with a base length of 100 feet and side slopes of 5H to 1V. The discharge channel is a well-defined, grass-lined open channel away from the embankment.

A 16-inch diameter steel pipe has been installed through the base of the dam embankment to serve as a reservoir drain. According to the design drawings, the upstream inlet of the pipe is without a trashrack or other protection, and is situated less than one foot above the reservoir bottom.

The pipe discharge is controlled by a 16-inch cast iron gate valve installed at the toe of the dam near the downstream end of the pipe. The valve is housed in a corrugated metal pipe vault with a cover. The pipe discharges directly into a drainage course at the toe of the dam. The pipe outlet is bare, but is shown to be supported by a concrete wall 8 feet upstream of its discharge end.

The reservoir at Henry Sever Dam impounds 2,106 acre-feet of water from a drainage area of 3.13 square miles. The reservoir is surrounded mostly by forested lands.

b. Location

The Henry Sever Dam is located on the Myers Branch of the South Fabius River, near the southeast corner of Knox County, Missouri. The nearest downstream community is Newark, Missouri, population 114, which is approximately one mile downstream from the dam. The dam and reservoir are shown on the Labelle Quadrangle Sheet (7.5 minute series) in Section 11, Township 60 North, Range 10 West.

c. Size Classification

According to the "Recommended Guidelines for Safety Inspection of Dams", by the U.S. Department of the Army, Office of the Chief Engineer, the dam is classified in the dam size category as being "Intermediate" since its storage is more than 1,000 acre-feet, but less than 50,000 acre-feet. The dam is also classified as "Intermediate" in dam size category because its height is more than 40 feet, but less than 100 feet. The overall size classification is, accordingly, "Intermediate" in size.

d. Hazard Classification

The dam has been classified as having "High" hazard potential in the National Inventory of Dams, on the basis that in the event of failure of the dam or its appurtenances, excessive damage could occur to downstream property, together with the possibility of the loss of life. Our findings concur with the classification. The estimated damage zone extends four miles downstream of the dam. Within the damage zone are two farmhouses with associated farm buildings, five trailer camping pads, one improved road crossing, and one state

highway crossing. The town on Newark, Missouri would also be affected in case of rupture of the dam. The floodplain is extensively farmed.

e. Ownership

Henry Sever Dam is owned by the Missouri Department of Conservation, North Ten Mile Drive, Jefferson City, Missouri 65101.

f. Purpose of Dam

The purpose of the dam is to impound water for recreational use in a recreational system operated by the Missouri Department of Conservation.

g. Design and Construction History

Henry Sever Dam was designed and constructed by the Missouri Department of Conservation in 1960 and 1961. No reconstruction has been performed on the dam or appurtenant structures since the original construction.

h. Normal Operational Procedures

The dam is used to impound water for use as a recreational lake. The reservoir is kept as full as possible, with the level controlled by rainfall, runoff, evaporation and capacity of the uncontrolled spillways. The only operating facility at the damsite is the low level drain, which is only used during an emergency to drain the reservoir.

1.3 Pertinent Data

a. Drainage Area	2,000 acres
b. Discharge at Damsite	All discharge at the damsite is through two uncontrolled spillways and a low level outlet drain
Estimated experienced maximum flood:	500 cfs
Estimated ungated spillway capacity at maximum pool elevation:	2,696 cfs

c. Elevation (Feet above MSL)

Top of dam:	688.0
Spillway crest: (Service spillway)	683.0
(Emergency spillway)	685.0
Minimum streambed elevation at centerline of dam:	645.0
Maximum tailwater:	Unknown

d. Reservoir

Length of maximum pool:	6,600 feet ±

e. Storage (Acre-Feet)

Top of dam:	3,001
Spillway crest (El. 683):	2,106

f. Reservoir Surface (Acres)

Top of dam:	200
Spillway crest (estimated): (Service spillway)	158

g. Dam

Type:	Earth embankment
Length:	1,160 feet
Height (maximum):	43 feet
Top width:	15 feet

Side slopes:	
Downstream	1V to 2-1/2H
Upstream	1V to 3H with a 10-foot wide horizontal berm at El. 678.0
Zoning:	None
Impervious core:	None
Cutoff:	Core trench with 10-foot bottom width and 1V to 1H side slopes
Grout curtain:	None

h. Diversion and Regulating Tunnel — None

i. Spillway

Type:	(Service spillway)	Uncontrolled
	(Emergency spillway)	Uncontrolled
Length of weir:	(Service spillway)	30 feet
	(Emergency spillway)	100 feet
Crest Elevation:	(Service spillway)	683.0 feet
	(Emergency spillway)	685.0 feet

j. Regulating Outlets

Type:	16-inch diameter steel pipe low level outlet
Length:	255 feet
Closure:	16-inch diameter cast iron gate valve
Maximum capacity:	27 cfs

SECTION 2: ENGINEERING DATA

2.1 Design

Original design drawings are available for the dam and appurtenant structures. These drawings were made in the early 1960's, and are given as plates in this report. No other design data is available.

2.2 Construction

The dam was constructed in 1961 by the Missouri Department of Conservation. No additional construction data is available. A representative of the owner indicated that no reconstruction has been done on the dam or appurtenant structures.

2.3 Operation

No operation records for Henry Sever Dam are available.

2.4 Evaluation

a. Availability

The only engineering data available is the original design drawings. No design computations, construction data, or operation data is available.

In addition, no pertinent data was available for review on hydrology, spillway capacity, flood routing through the reservoir, outlet capacity, slope stability, or seepage analysis.

b. Adequacy

The design drawings are adequate to aid in evaluating the adequacy of the hydraulic and hydrologic capabilities and stability of the dam for Phase I investigations.

The lack of engineering data, other than design drawings, did not allow for a definitive review and evaluation. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing and evaluating design, operation and construction data, but is based primarily on visual inspection with the aid of the available design drawings, past performance history and sound engineering judgment.

Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These seepage and stability analyses should be performed for appropriate loading conditions (including earthquake loads) and made a matter of record.

c. Validity

The dam and appurtenant structures were constructed in accordance with the available design drawings.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

A visual inspection of Henry Sever Dam was made on September 27, and October 4, 1978. The following persons were present during the inspection:

Name	Affiliation	Disciplines
Yin Au-Yeung	Engineering Consultants, Inc.	Project Engineer, Hydraulics and Hydrology
David Bramwell	Engineering Consultants, Inc.	Geology
Jon Diebel	Engineering Consultants, Inc.	Soils & Stability
John Ismert	Engineering Consultants, Inc.	Mechanical
Kevin Blume	Consoer, Townsend & Assoc., Ltd.	Civil & Structural

Specific observations are discussed below.

b. Dam

The crest of the dam has a heavy vegetative cover which adequately protects the embankment material. The grass had been recently cut. Some evidence of vehicular traffic can be seen on the crest, but does not appear to be extensive. Many surface desiccation cracks were observed on the crest, but appear to be only from wetting and drying of the clay embankment material, and not from settlement or movement of the embankment.

The upstream embankment slope is, for the most part, adequately protected by the riprap described earlier. Some thinning of the riprap and subsequent embankment sloughing is occurring near the left side of the dam, but is not serious at this time, and can be repaired by normal maintenance. No degradation of the riprap blocks due to weathering was observed.

The downstream embankment slope is well protected by vegetative cover. The cover consists of grasses as tall as 4 feet in some areas. The embankment material could be observed in the discharge channel for the low level gate, and is a low to medium plastic clay with 5 to 10 percent sand. The material would be classified as CL by the Unified Soil Classification System.

No signs of past or present instability was seen on the embankment or in the foundation at any location. Also, no seepage was observed on the downstream embankment slope or downstream of the toe. Rodent activity was not observed to any significant degree on the embankment.

c. Appurtenant Structures

(1) Spillway

The service spillway is located at the right abutment of the dam and the crest structure is a U-shape concrete drop inlet which connects to a concrete bridge section, and then into a concrete spillway chute channel and a stilling basin before entering into the exit channel. Minor leakage was visible along the vertical construction joints between the concrete spillway chute channel and the crest structure. Concrete in the spill-

way crest, the bridge and the chute floor is in acceptable condition. The chute walls are also in acceptable condition, but showing some minor surface deterioration. The jointing in walls is in good alignment, but minor vertical cracks were seen on the stilling basin walls. The concrete bridge is in acceptable condition for light vehicular traffic. The spillway approach channel is well-defined, but poorly maintained. Heavy vegetative growth was observed in the approach channel. The spillway discharge channel is also well-defined, but also filled with heavy vegetative growth. Minor erosion was observed along the earth cut in the stilling basin area.

(2) Emergency Spillway

The emergency spillway is a grass-lined open channel which is located at the left abutment of the dam. This spillway is well-defined and well-maintained, and in very good condition.

(3) Outlet Works

The corrugated metal pipe pit and cover are in good condition. The cover could be lifted to inspect the gate valve. The valve appears to be in good operating condition, with plastic sheeting provided over the valve for protection. The interior surface of the portion of the pipe which could be inspected was dry, mildly rusted, and satisfactory. The concrete support wall was apparently buried and could not be observed.

The discharge channel is heavily vegetated and obstructed by trees and brush.

d. Reservoir Area

The water surface elevation was 682.33 at the time of the inspection.

The major portion of the reservoir rim is gently sloped. No indications of instability, excessive erosion, or slides were readily apparent along the shore of the reservoir.

e. Downstream Channel

The discharge channel immediately downstream from the stilling basin is well-defined and about 25-feet wide. The side slopes are approximately 1V to 3H, and show no signs of erosion or sloughing. However, the entire downstream channel is full of vegetative growth, which will reduce the hydraulic efficiency of the channel.

3.2 Evaluation

The visual inspection did not exhibit any items which are sufficiently significant to indicate a need for immediate remedial action.

The following items were observed which could affect the safety of the dam, or which will require maintenance within a reasonable period of time.

1. The upstream embankment slope near the left side of the dam which demonstrated thinning of riprap and sloughing of embankment material.

2. Heavy vegetative growth in the service spillway approach channel.

3. Heavy vegetative growth in the service spillway discharge channel.

4. Heavy vegetation in the low level outlet pipe discharge channel.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

Henry Sever Dam impounds water for use as a recreational lake. The dam stores as much water as possible, with additional inflow passing through the service spillway or emergency spillway. A low level gate is provided for possible draining of the reservoir, but releases are rarely made through the gate and appurtenant piping. The reservoir is essentially controlled by rainfall, runoff, evaporation and capacity of the uncontrolled spillways. No daily measurements are taken at the damsite.

4.2 Maintenance of Dam

The dam is maintained by the Missouri Department of Conservation. Maintenance of the dam and appurtenant structures appeared to be satisfactory. Evidence of maintenance being performed including cutting of the grass on the dam crest, addition of riprap to some areas on the upstream slope of the embankment, and a plastic covering over the handwheel in the gate vault for the low level outlet. Some areas of the upstream embankment slope need additional riprap at this time. In addition, the discharge channels are generally obstructed with heavy vegetative growth, including trees.

4.3 Maintenance of Operating Facilities

The low level outlet valve is the only operating facility at the damsite. This gate is operated very infrequently. The gate appeared to be maintained well, and in satisfactory operating condition.

4.4 Description of Any Warning System in Effect

The inspection team is not aware of any existing warning system for this dam.

4.5 Evaluation

The operation and maintenance for this dam is satisfactory. Very little operation is required for the reservoir. Maintenance for the dam and appurtenant structures appears to be adequate, with the exception of items discussed in Section 4.2.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design

Henry Sever Lake has a watershed of approximately 2,000 acres. Land gradients in the higher portion of the watershed average roughly 3 percent, and slope gradually to about 4 percent around the reservoir. The lake is located on the Myers Branch, which is a tributary of the South Fabius River.

Elevations within the watershed range from approximately 683 feet above MSL at the damsite to over 775 feet above MSL in the upper portion of the watershed.

The watershed is approximately 20 percent covered by trees and forests, with the remainder being covered by grass and brush. A drainage map showing the watershed area is included in Appendix B.

Evaluation of the hydraulic and hydrologic features of Henry Sever Dam was based on criteria set forth in the Corps of Engineers' Recommended Guidelines for Safety Inspection of Dams, and additional guidance provided by the St. Louis District of the Corps of Engineers. The Probable Maximum Flood (PMF) was calculated from the Probable Maximum Precipitation (PMP) using the methods outlined in the U.S. Weather Bureau Publication, Hydrometeorological Report No. 33. The probable maximum storm duration was set at 24 hours, and storm rainfall distribution was based on cri-

teria given in EM 1110-2-1411 (Standard Project Storm). The SCS triangular hydrograph, transformed to a curvilinear hydrograph, was adopted for developing the unit hydrograph. The derived unit hydrograph is presented in Appendix B.

Initial and infiltration loss rates were applied to the PMP to obtain rainfall excesses. The rainfall excesses were then applied to the unit hydrograph to obtain the PMF hydrograph, utilizing the Corps of Engineers' computer program HEC-1, (Dam Safety Version), which was prepared specifically for dam safety analysis. The computed peak discharge of the PMF and one-half of the PMF are 20,410 cfs and 10,205 cfs, respectively.

Both the PMF and one-half of the PMF inflow hydrographs were routed through the reservoir by the Modified Puls Method, also utilizing the HEC-1 (Dam Safety Version) computer program. The peak outflow discharges for the PMF and one-half of the PMF are 16,914 cfs and 6,780 cfs, respectively. Both the PMF and one-half of the PMF, when routed through the reservoir, resulted in overtopping of the dam.

The stage-outflow relation for the spillway was prepared from field notes, sketches and limited construction drawings. The reservoir stage-capacity data were based on the U.S.G.S. quadrangle topographic maps in combination with data given in the National Dam Safety Inventory Table. Reservoir storage capacity included surcharge levels exceeding the top of the dam, and the spillway overtop rating curve assumed that the dam remains intact during routing. In the routing computations, the discharge through the outlet facilities was excluded due to its insignificant magnitude as compared to the spillway discharge and the PMF. The combined spillway rating curve (both emergency spillway and service spillway) and the reservoir capacity curve are also presented in Appendix B.

From the standpoint of dam safety, the hydrologic design of a dam aims at avoiding overtopping. Overtopping is especially dangerous for an earth dam because the downrush of waters over the crest will erode the dam face and, if continued long enough, will breach the dam embankment and release all the stored water suddenly into the downstream floodplain. The safe hydrologic design of a dam calls for a spillway discharge capability, in combination with an embankment crest height that can handle a very large and exceedingly rare flood without overtopping.

The Corps of Engineers designs its dams to safely pass the Probable Maximum Flood that is estimated could be generated from the upstream watershed. This is the generally accepted criterion for major dams throughout the world, and is the standard for dam safety where overtopping would pose any threat to human life. Although dams that do not fully meet this standard will not be evaluated as "unsafe", the Corps considers the minimum hydrologic requirement for safety for this dam to be the capability to pass the Probable Maximum Flood without overtopping.

b. Experience Data

No records of reservoir stage or spillway discharge are maintained for this site. However, according to interviews with local residents, the maximum reservoir level was above 6 inches over the emergency spillway in 1975.

c. Visual Observations

The service spillway structure and stilling basin are adequately maintained. However, the spillway approach channel is full of vegetative growth. The downstream channel is well defined, but contains thick tree growth in the channel bottom. The spillway and exit channel are at the furthest right abutment. Spillway releases will not endanger the structural integrity of the dam. Reservoir water surface was 8 inches below the concrete spillway crest at the time of the inspection.

d. Overtopping Potential

As indicated in Section 5.1-a., both the Probable Maximum Flood and one-half of the Probable Maximum Flood, when routed through the reservoir, resulted in overtopping of the dam. The PMF and one-half of the PMF overtopped the dam crest by 2.32 feet and 0.83 feet, respectively. The total duration of embankment overflow is 5.10 hours during the PMF, and 2.50 hours during one-half of the PMF. The spillway of the Henry Sever Dam is capable of passing a flood equal to approximately 34 percent of the PMF just before overtopping the dam. The 100-year flood is equal to approximately 11 percent of the PMF, therefore, the spillway will pass the 100-year flood without overtopping of the dam. Since the PMF is the minimum Spillway Design Flood (SDF) for Henry Sever Dam, according the the Recommended Guidelines for Safety Inspection of Dams by the Corps, the spillway capacity of the dam is considered "Inadequate".

The effect from rupture of the dam could extend approximately four miles downstream of the dam. There are two farmhouses with associated farm buildings, five trailer camping pads, one improved road crossing, one state highway crossing, and the town of Newark within this four miles of floodplain area. The floodplain is extensively farmed.

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

There were no signs of settlement or distress observed on the embankment or foundation during the visual inspection. The upstream slope, crest, and downstream slope are well protected by either riprap or vegetation. Seepage was not observed on the downstream slope or beyond the toe of the embankment. Some minor sloughing of the upstream embankment slope was occurring on the left side of the dam.

The concrete spillway drop inlet structure, the bridge section, and the spillway and chute slab exhibit no visual evidence of major cracking, failure, undermining or misalignment. Minor vertical cracks were observed along the stilling basin walls. However, these minor cracks do not pose any danger to the structural integrity of the spillway structure or the embankment.

No problems were observed with the low level outlet, which would jeopardize the safety of the dam.

b. Design and Construction Data

No design or construction data relating to the structural stability of the dam and appurtenant structures were found. No design data relating to seepage and stability analyses are known to exist.

c. Operating Records

No operating records are available relating to the stability of the dam. Water levels have not been recorded, however, the dam was within 1 foot of being full on the day of inspection, and is assumed to be close to full at all times. The only operation facility at the dam is a low level outlet pipe which is very rarely used.

d. Post Construction Changes

No post construction changes exist which will affect the structural stability of the dam.

e. Seismic Stability

In general, projects located in Seismic Zones 0, 1 and 2 may be assumed to present no hazard from earthquake, provided the static stability conditions are satisfactory, and conventional safety margins exist. Henry Sever Dam is located in Seismic Zone 1. A detailed seismic analysis is not felt to be necessary for this embankment.

SECTION 7: ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment

The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

It should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team.

It is also important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that an unsafe condition could be detected.

a. Safety

The spillway capacity has been found to be "inadequate". The PMF and one-half of the PMF overtopped the dam crest by 2.32 and 0.83 feet, respectively. As stated previously, overtopping of the embankment will carry with it a high risk of total failure of the embankment by erosive action of the overtopping water. The dam was found to be able to safely pass a 100-year flood.

Several other items were observed during the visual inspection which should be repaired within a reasonable period of time. These items include:

1. The upstream embankment slope near the left side of the dam which demonstrated thinning of riprap and sloughing of embankment material.

2. Heavy vegetative growth in the service spillway approach channel.

3. Heavy vegetative growth in the service spillway discharge channel.

4. Heavy vegetation in the low level outlet pipe discharge channel.

b. Adequacy of Information

Information concerning operation and maintenance of the dam and appurtenant structures is somewhat lacking. It is recommended that the following programs be initiated to help alleviate this problem:

1. Annual inspection of the dam by a professional engineer experienced in the design and construction of earthen dams should be made and this inspection report made a matter record.

2. Set up a maintenance schedule and log all visits to the dam for operation, repairs and maintenance.

3. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of dams.

The design drawings, together with performance history and visual inspection findings is felt to be adequate information to support the conclusions presented in this report.

c. Urgency

The remedial measures recommended in Paragraph 7.2 should be accomplished within a reasonable period of time.

Increasing the spillway capacity is certainly of a more urgent nature than the other recommended actions.

d. Necessity for Phase II Inspection

Based on results of the Phase I inspection, a Phase II inspection is not felt to be necessary.

7.2 Remedial Measures

a. Alternatives

Possible alternatives for increasing the spillway capacity of the dam include:

1. Increasing the length of the service spillway crest.

2. Lowering the crest of either the service or emergency spillway.

3. Increasing the length of the crest of the emergency spillway by cutting farther into the left abutment.

4. Increasing the height of the dam embankment.

b. O & M Maintenance Procedures

The owner should initiate the following programs:

1. Annual inspection of the dam by a professional engineer experienced in the design and construction of earthen dams.

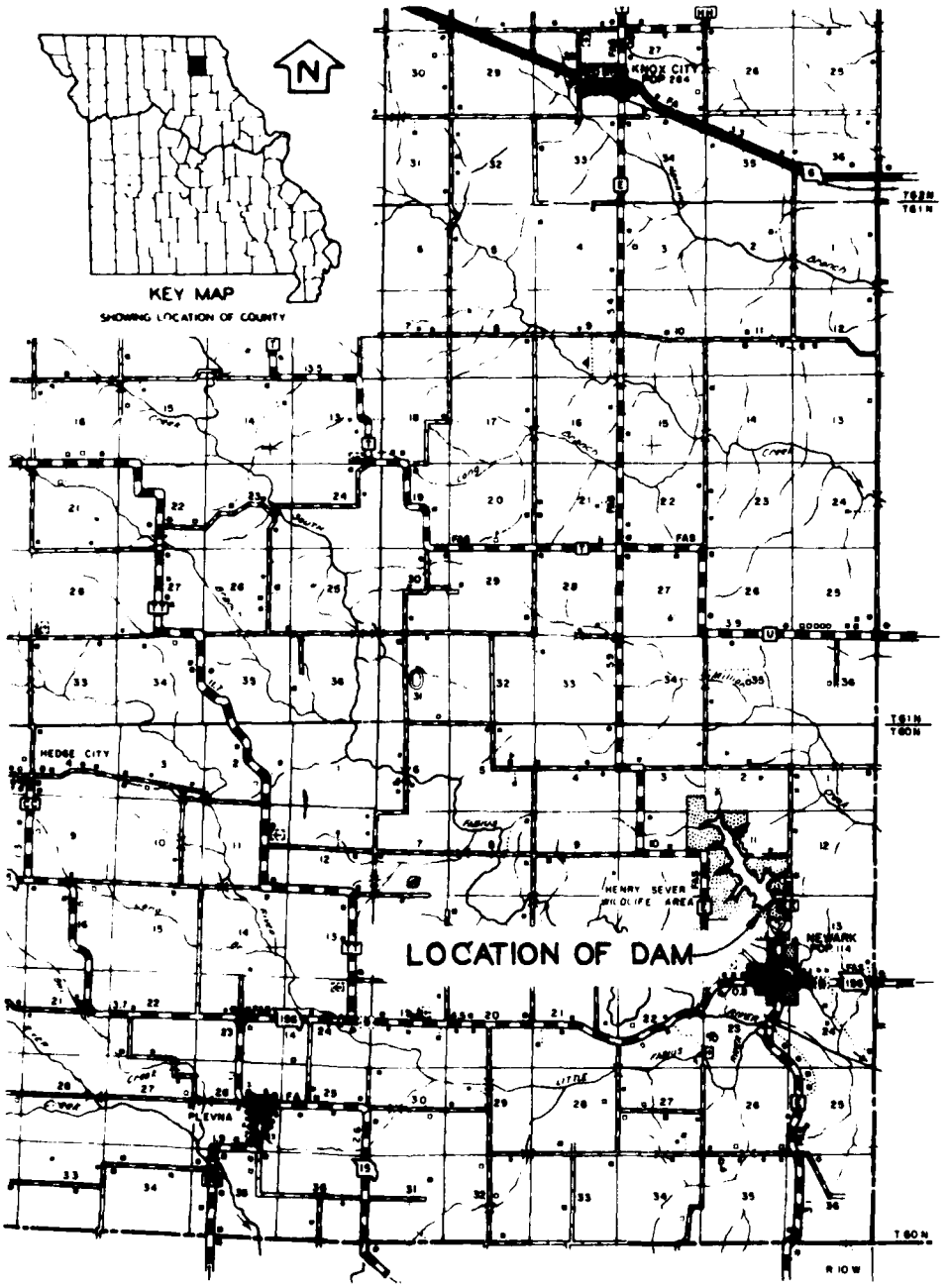
2. Set up a maintenance schedule and log all visits to the dam for operation, repairs and maintenance.

3. Place additional riprap on the upstream embankment slope near the left side of the dam.

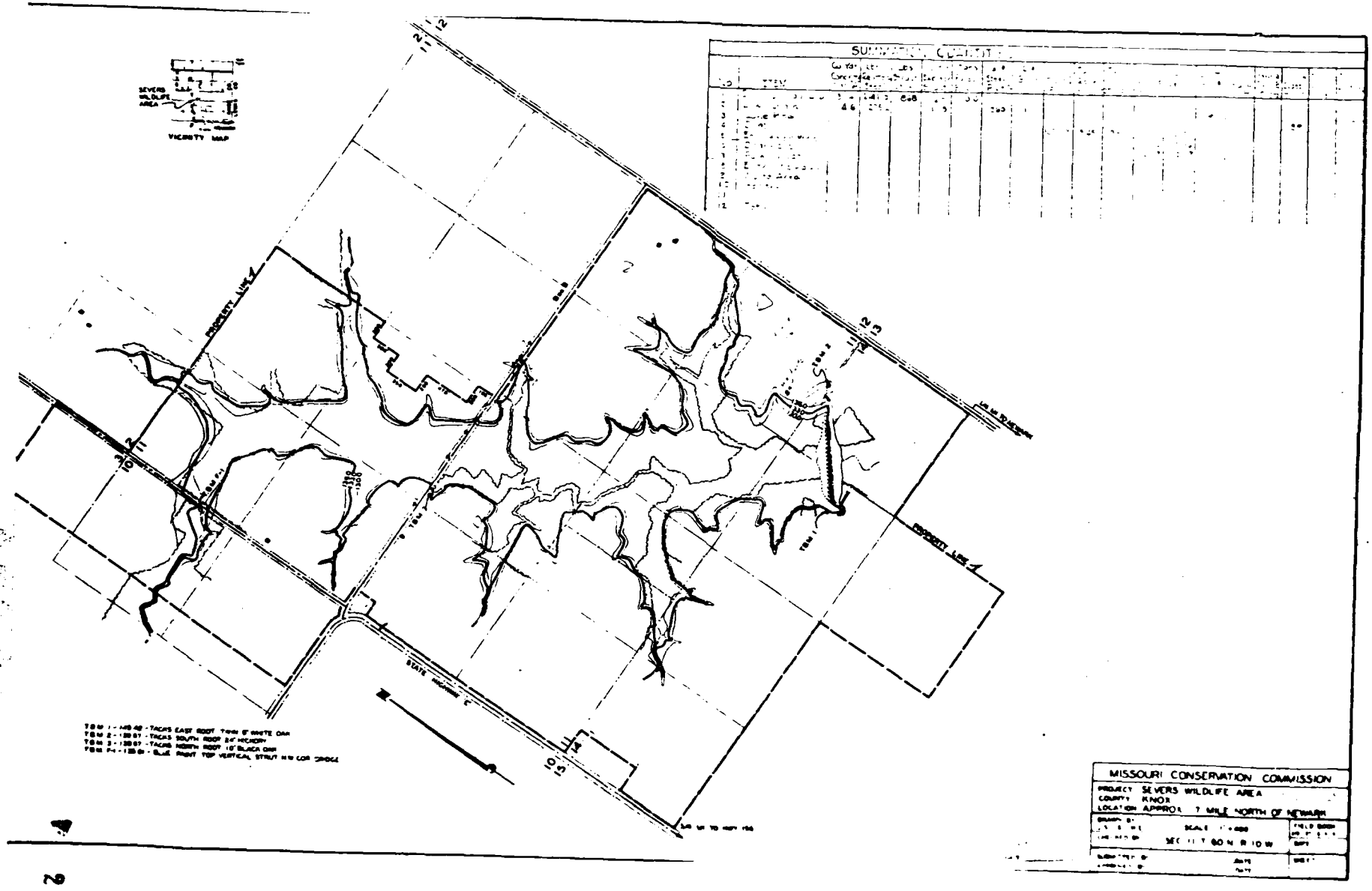
4. Clear vegetative growth in the service spillway approach and discharge channels, and the low level outlet pipe discharge channel. This should include removal of all trees and large brush for the entire width of the channel, and for a length of 50 feet below the downstream toe of the dam.

5. Seepage and stability analyses should be performed by a professional engineer experienced in the design and construction of earthen dams.

PLATES

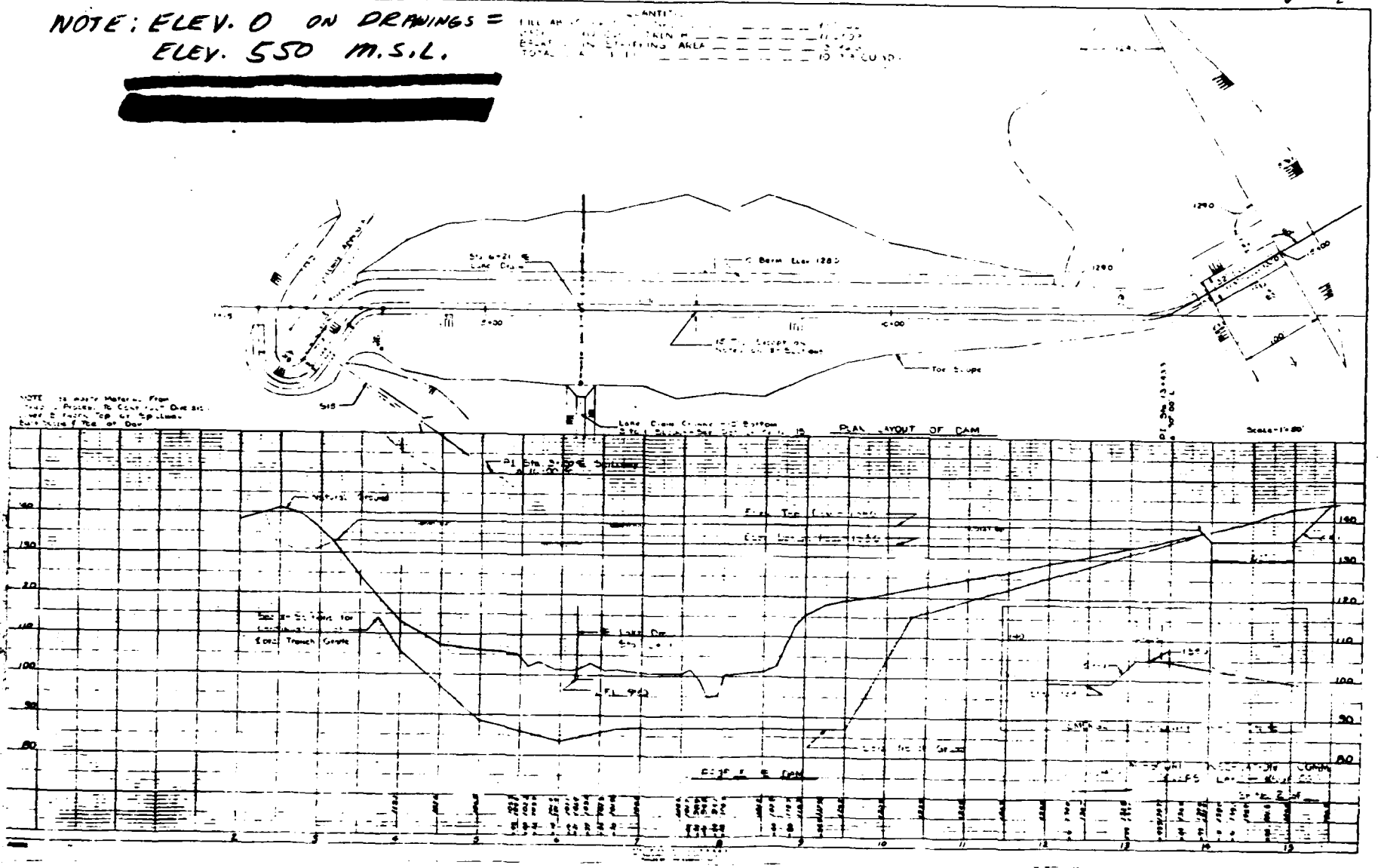


LOCATION MAP
HENRY SEVER DAM
KNOX COUNTY, MISSOURI


VICINITY MAP
PROPERTY LINE
STATE HIGHWAY C
MISSOURI CONSERVATION COMMISSION
PROJECT SEVERS WILDLIFE AREA
COUNTY KNOX
LOCATION APPROX. 7 MILE NORTH OF NEWARK
SCALE
SEC. 11 T 60 N R 10 W

NOTE: ELEV. 0 ON DRAWINGS =
ELEV. 550 M.S.L.

[redacted]



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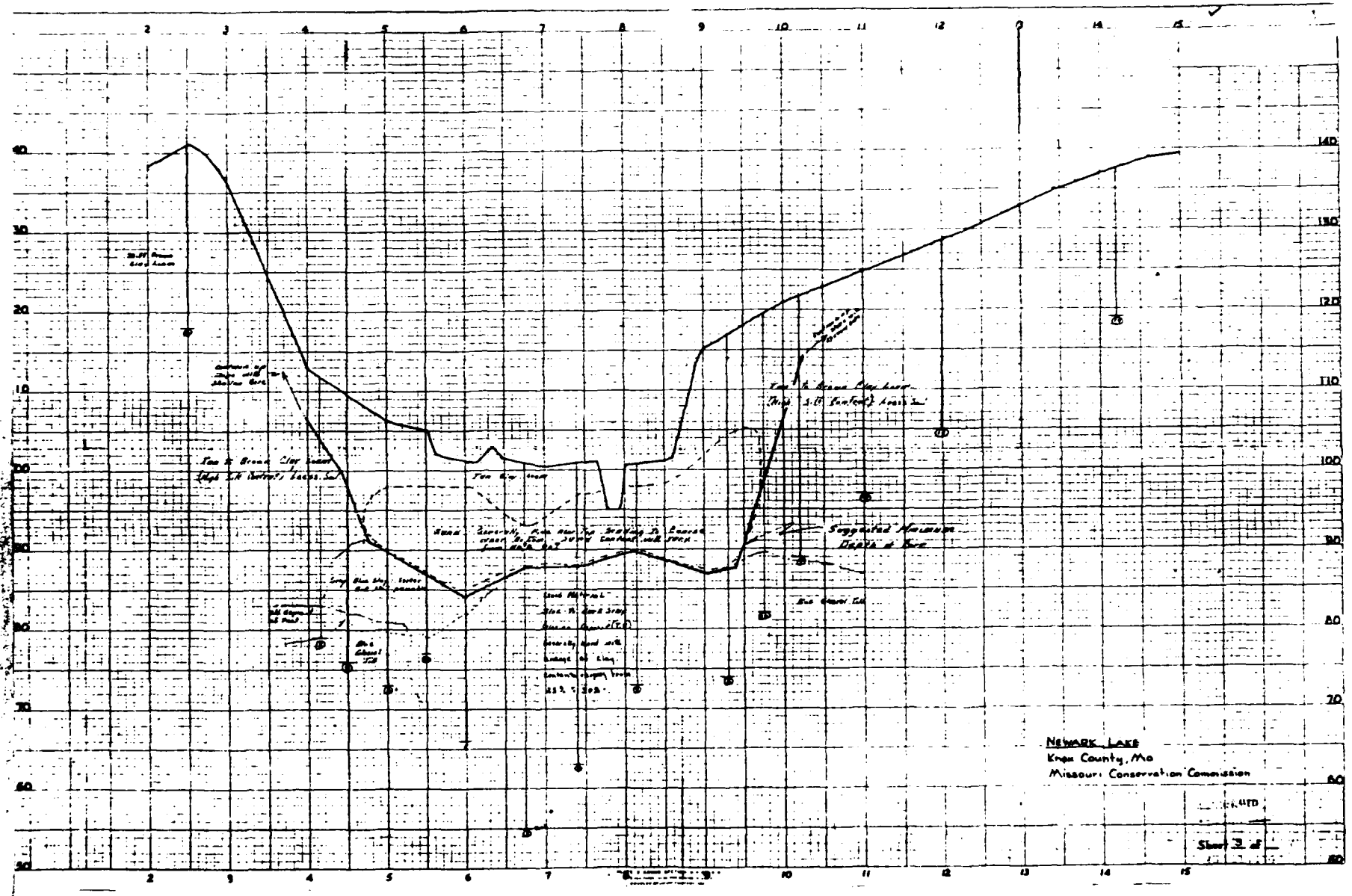
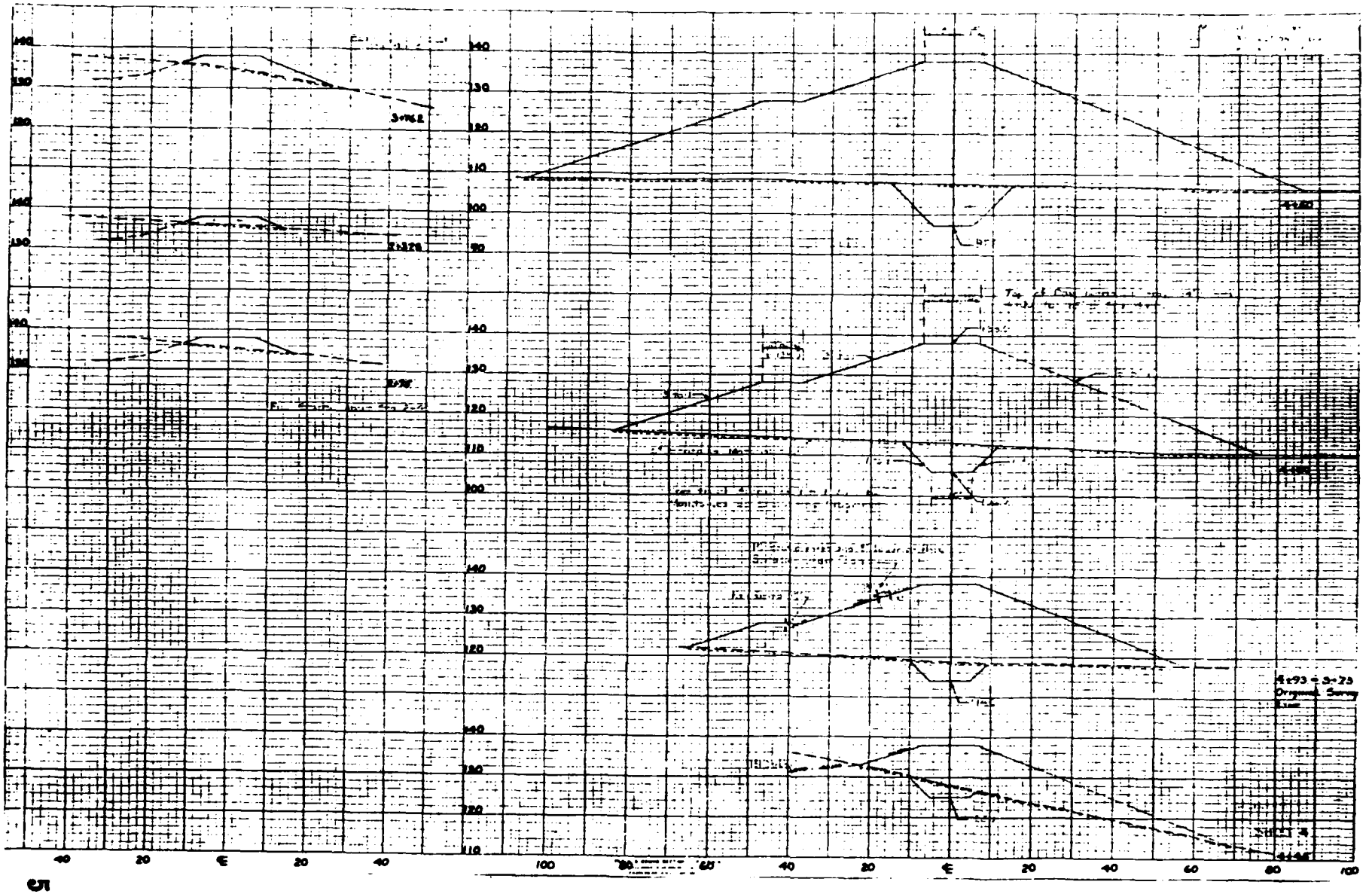
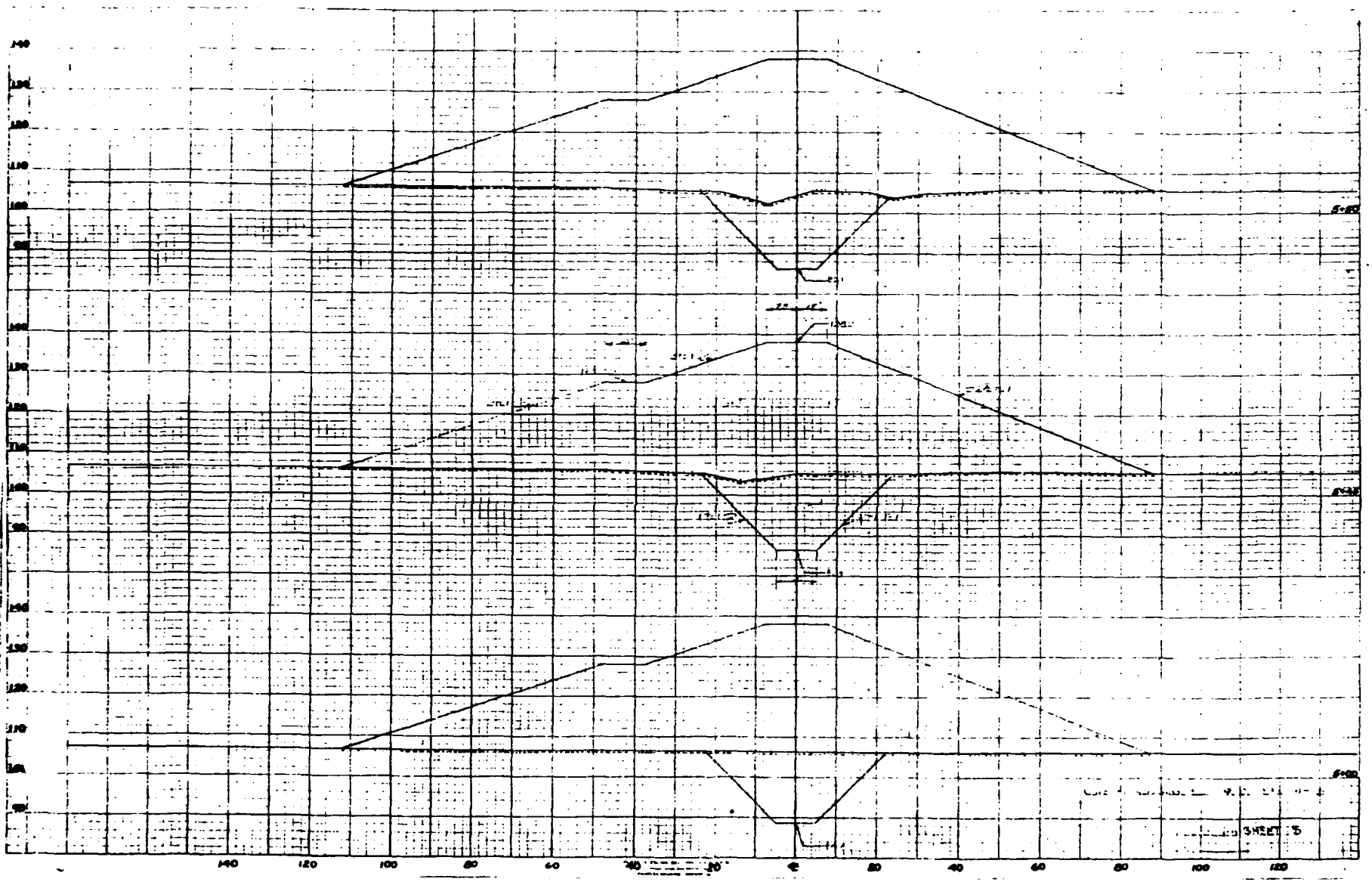

NEWARK LAKE
Knox County, Mo
Missouri Conservation Commission
Sheet 3 of

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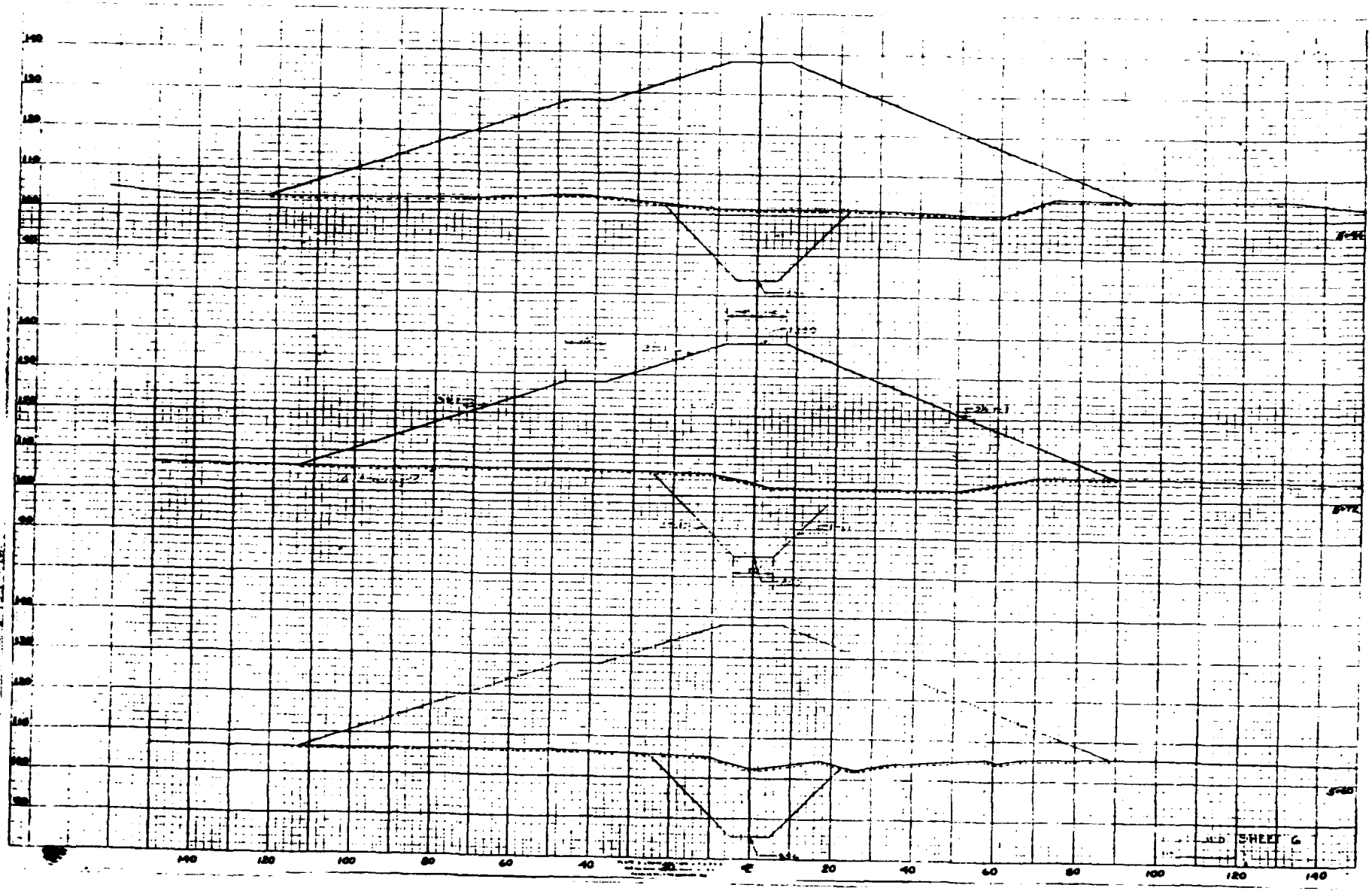
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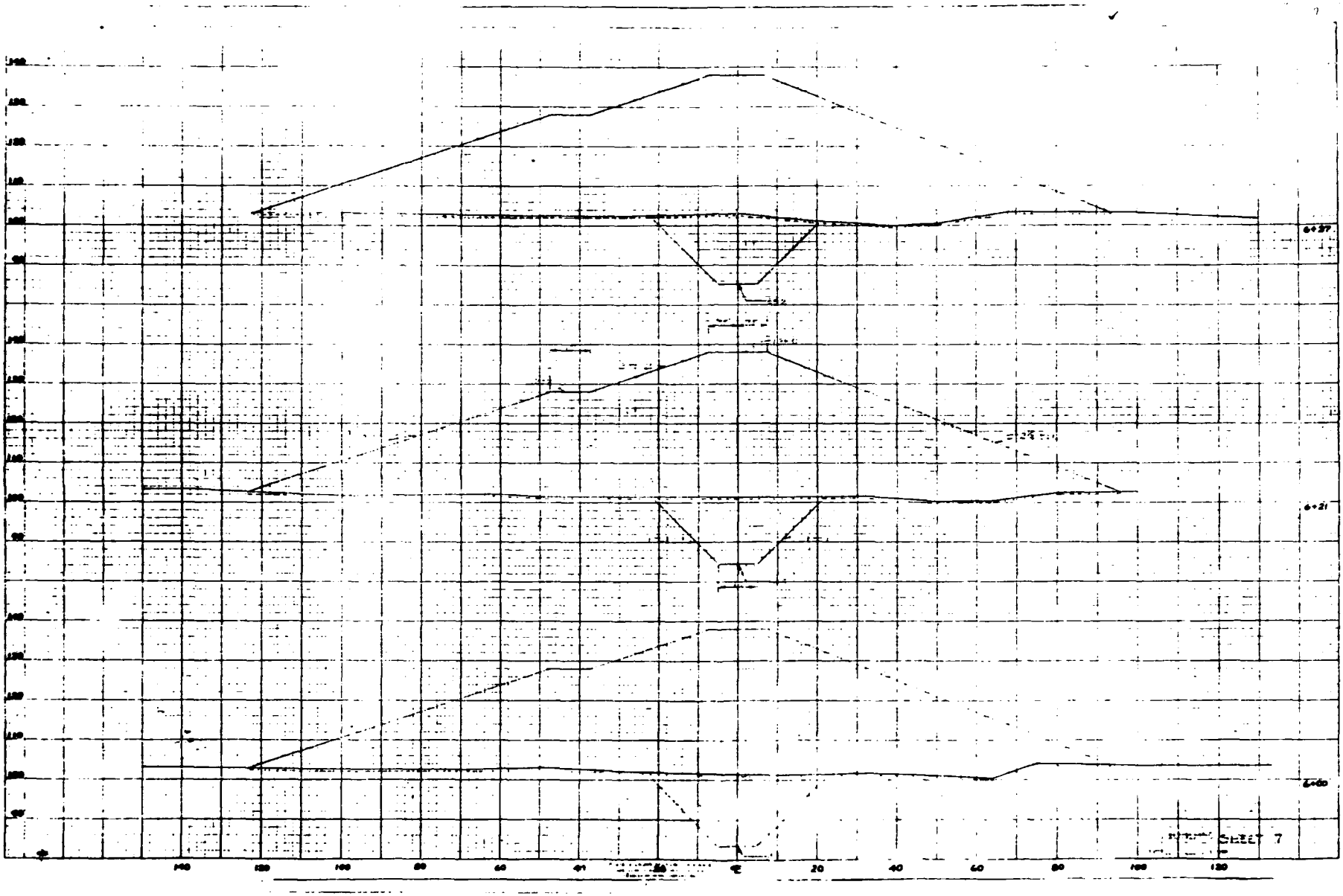
120
100
80
60
40
20
0
20
40
60
80
100
120
140
SHEET 6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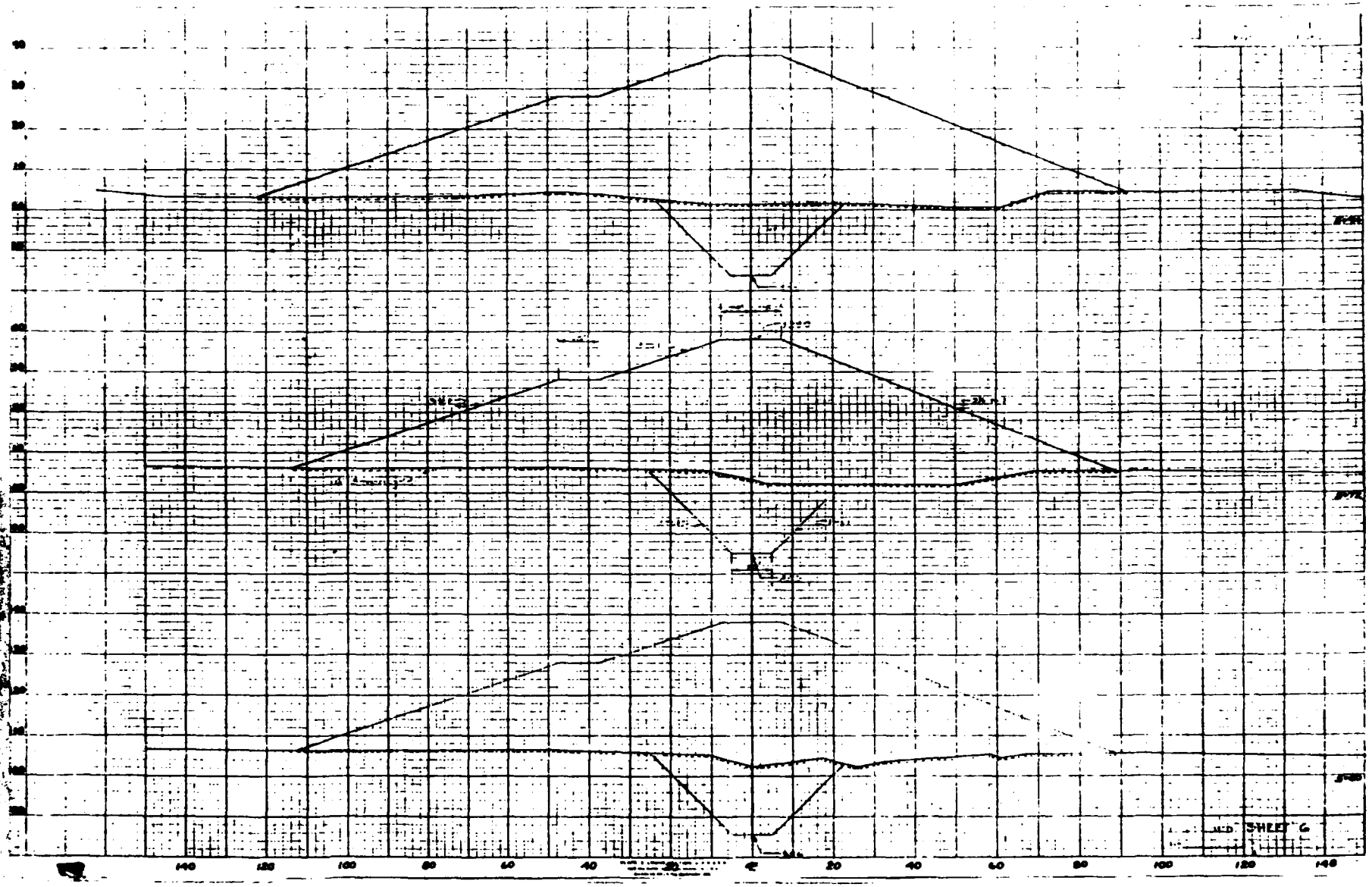
6+21
6+00
SHEET 7



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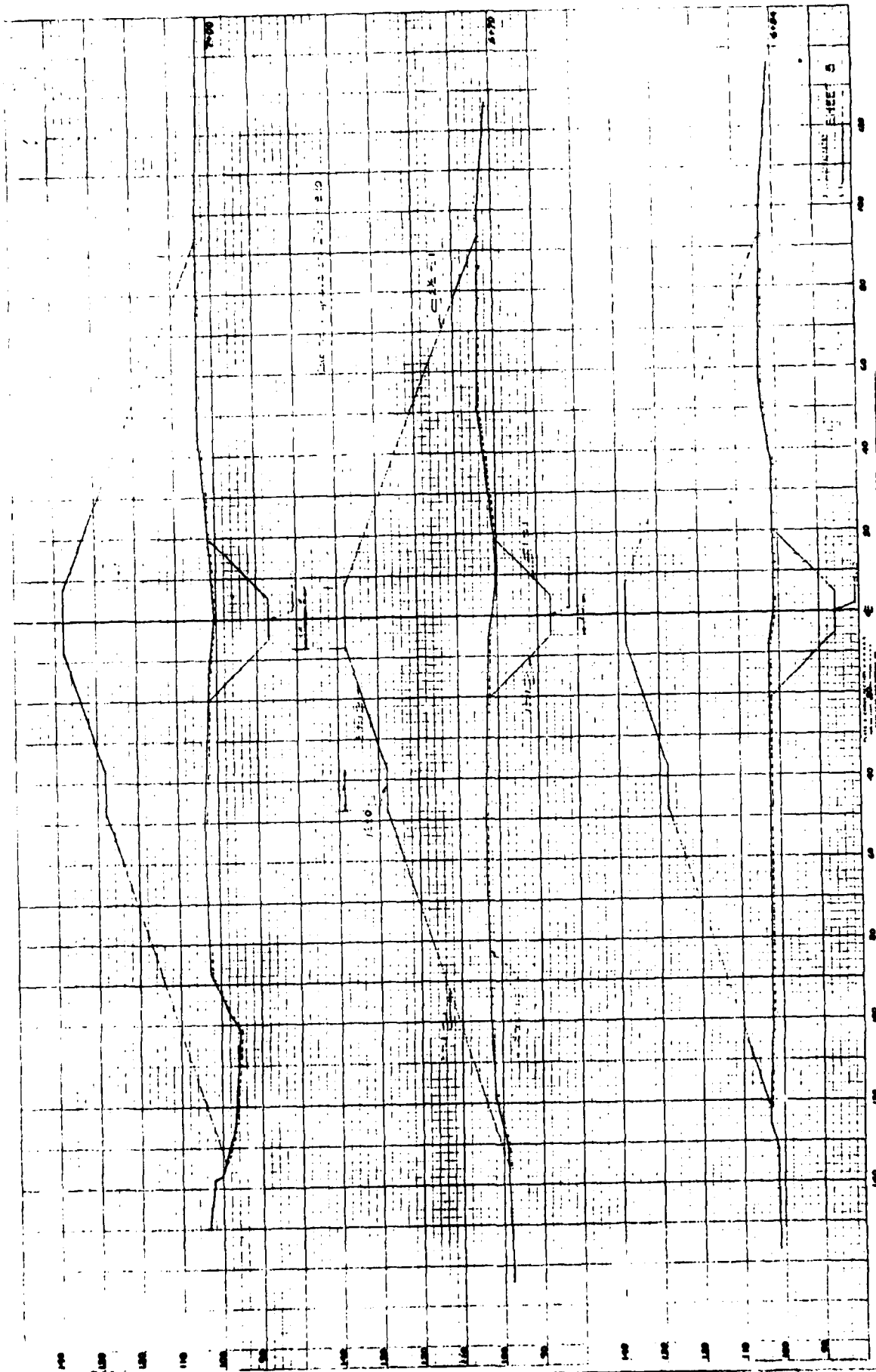

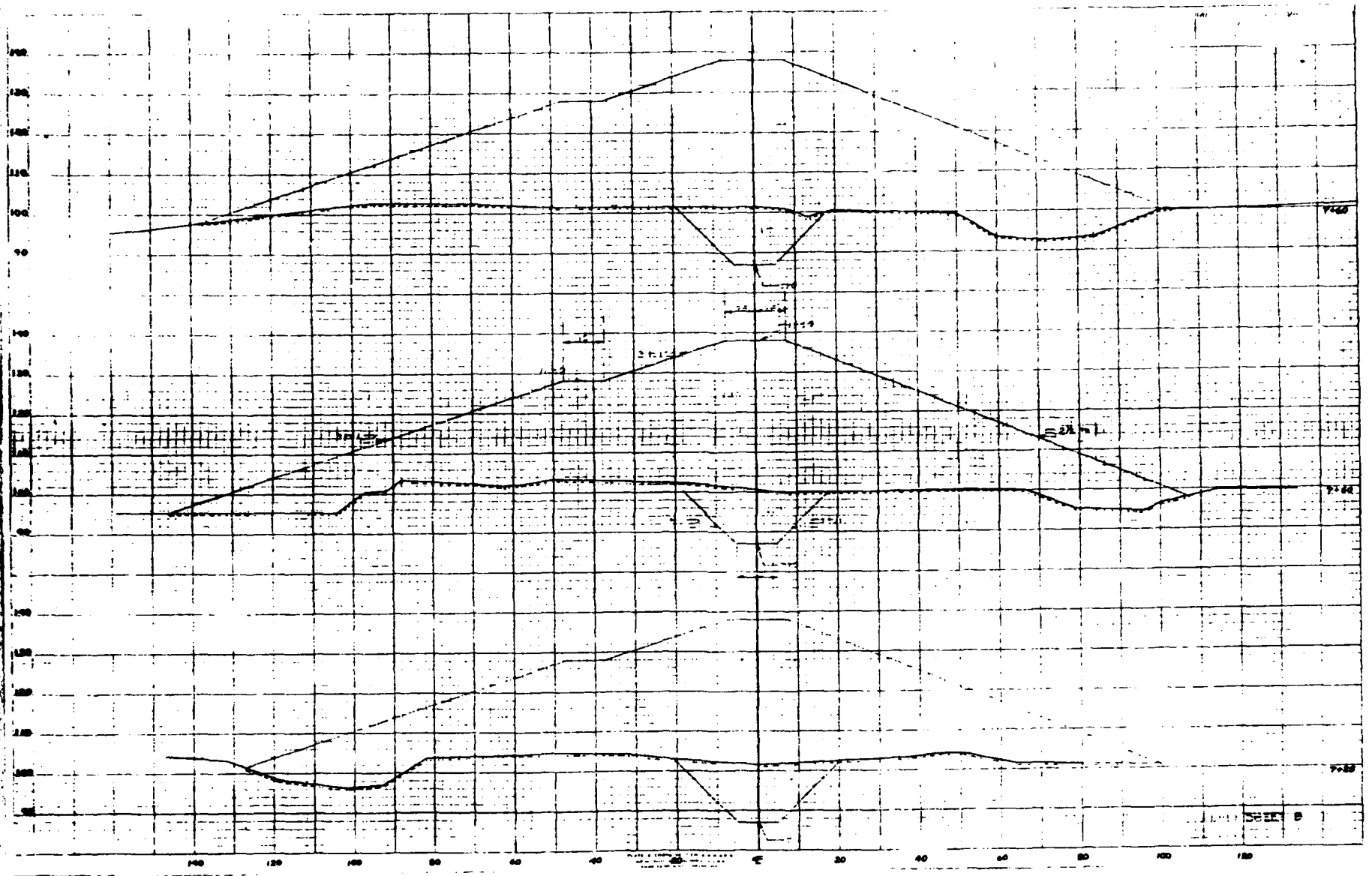

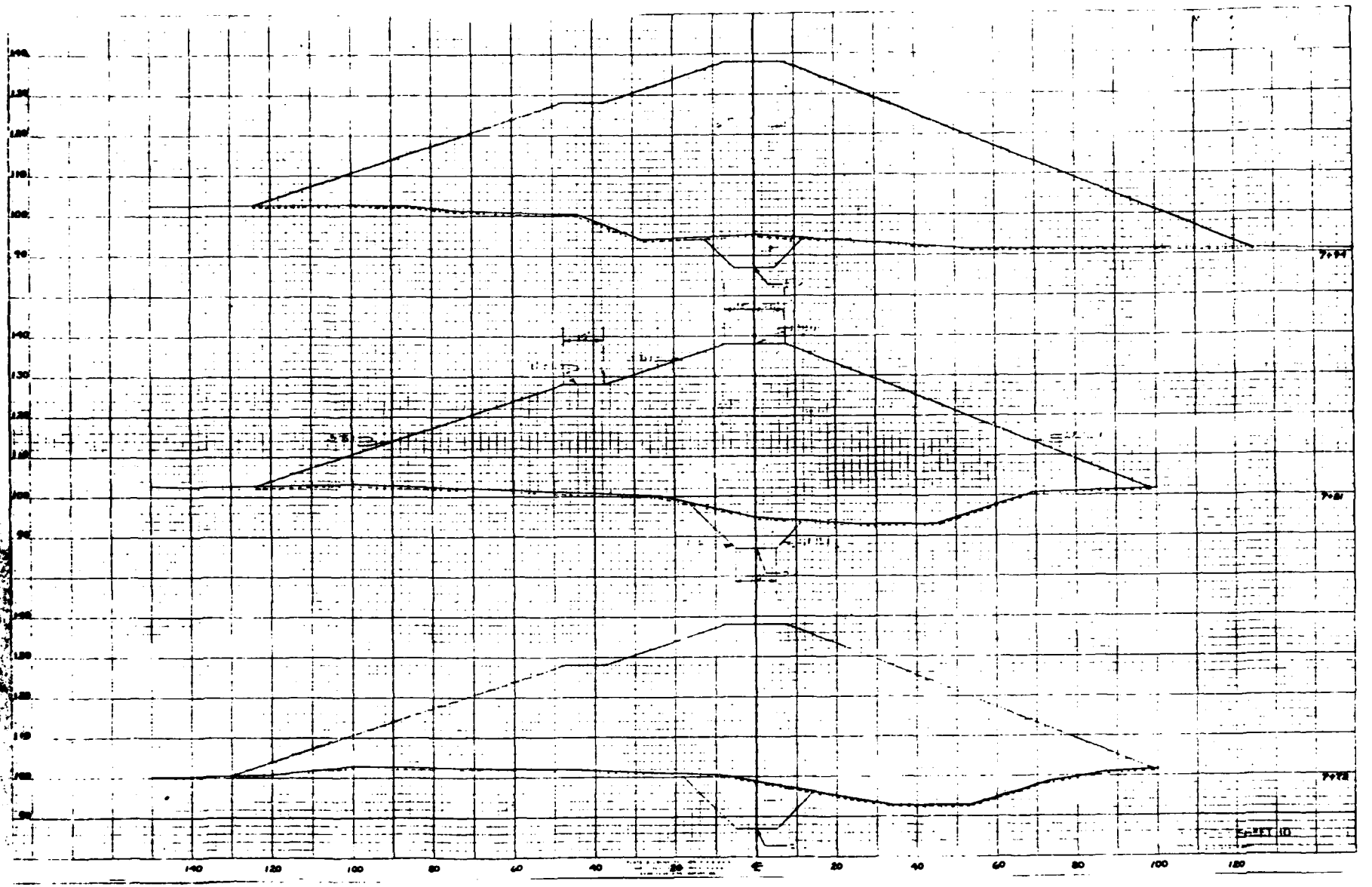

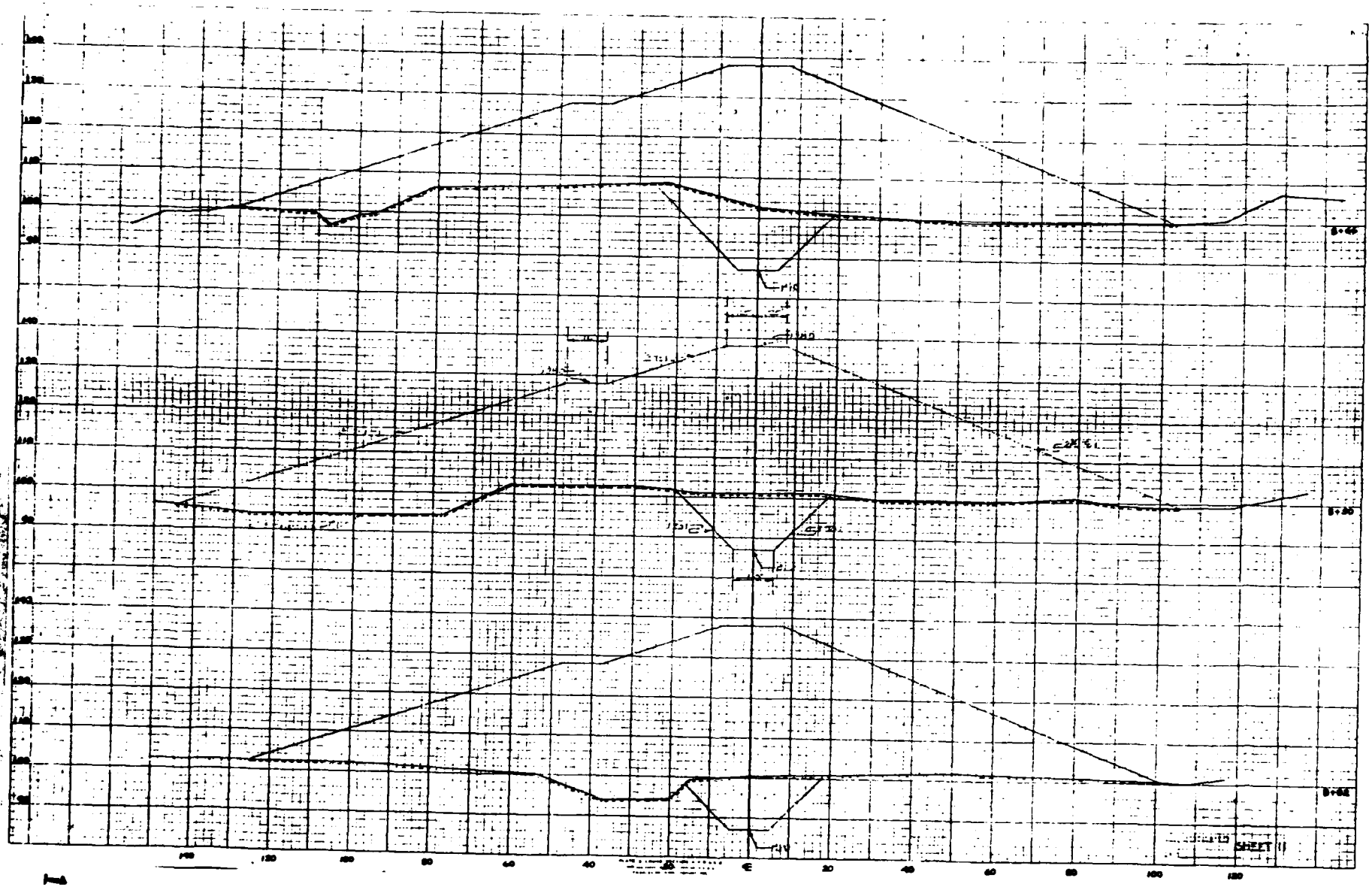
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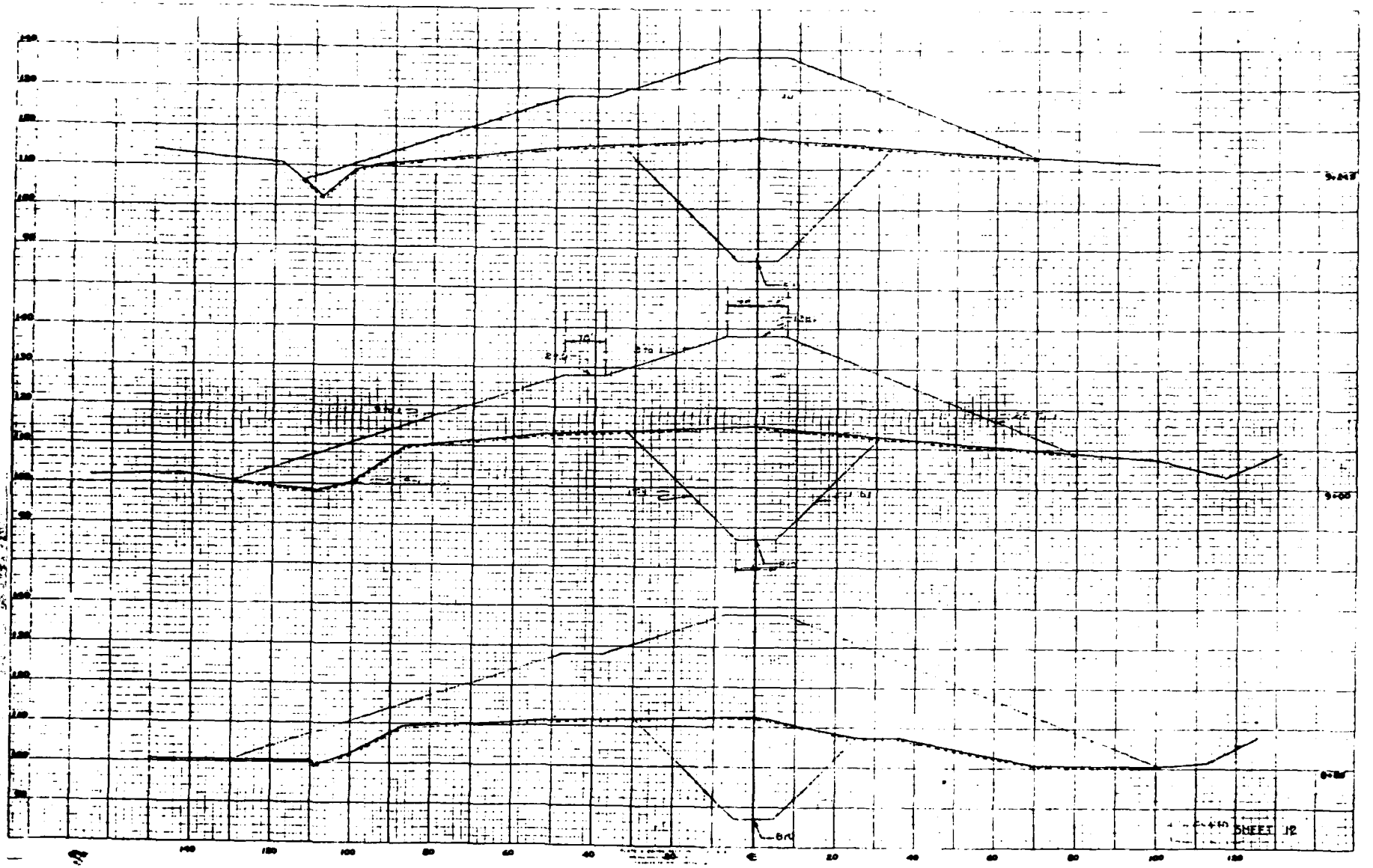
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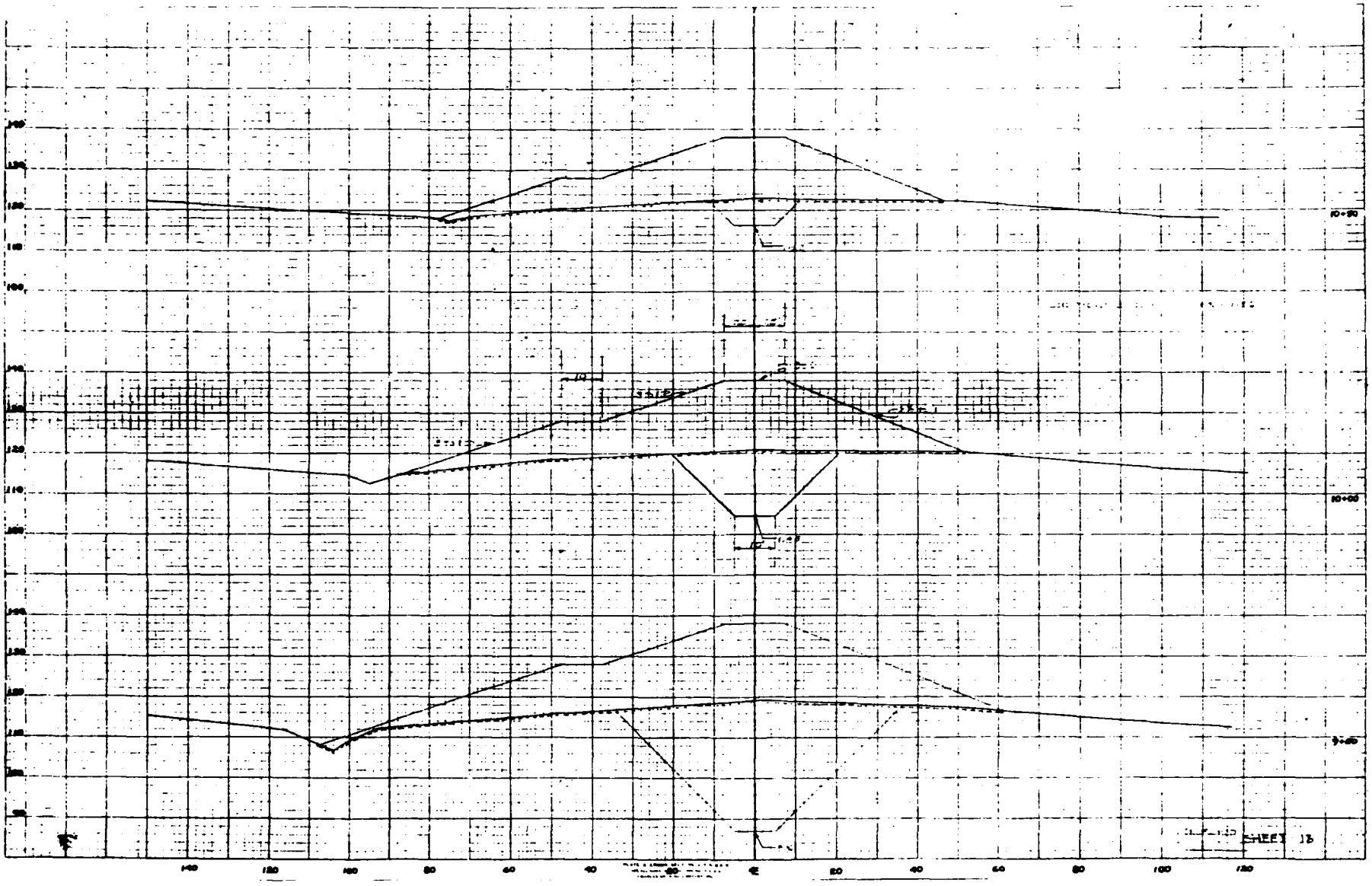
10+50
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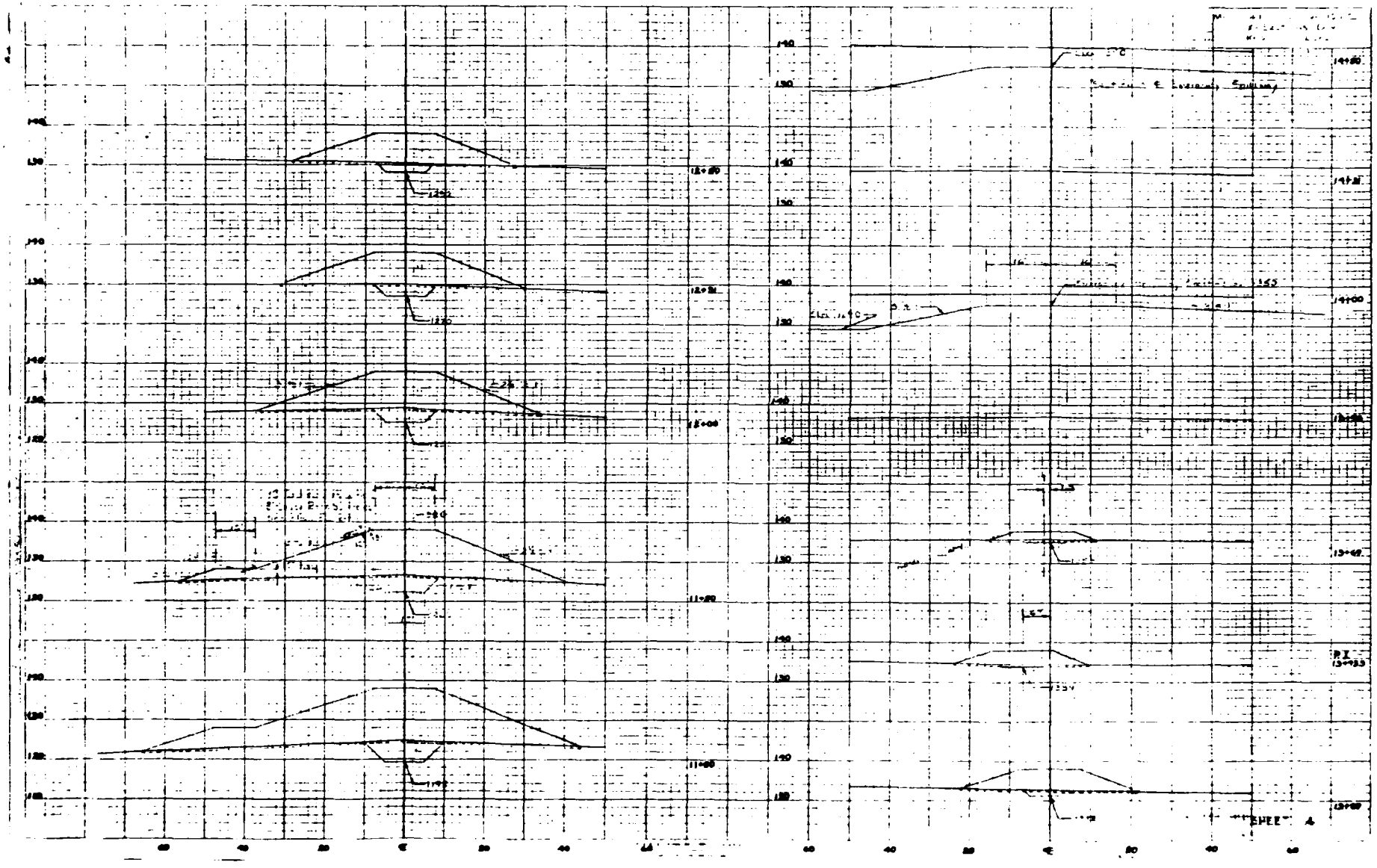
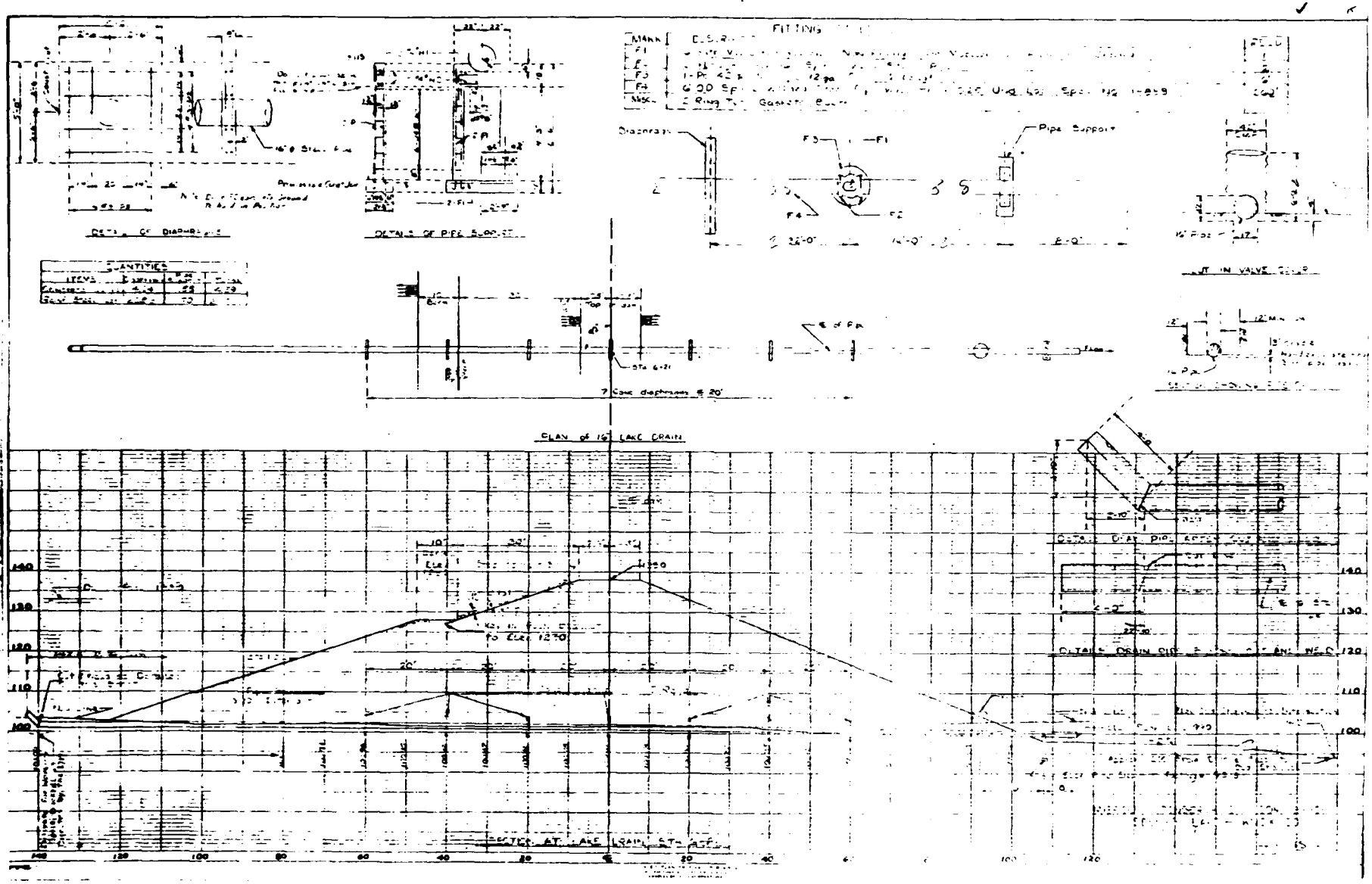
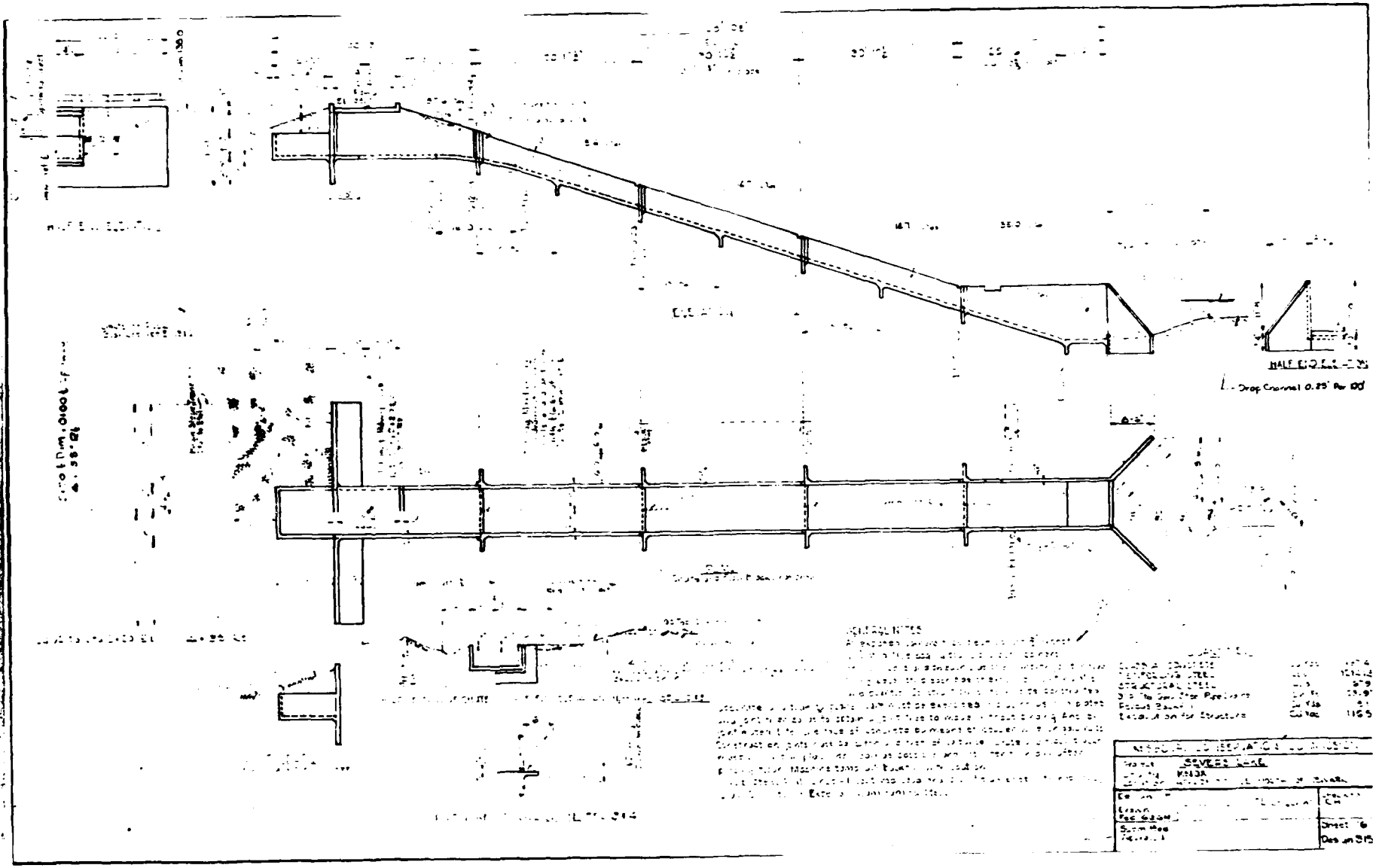
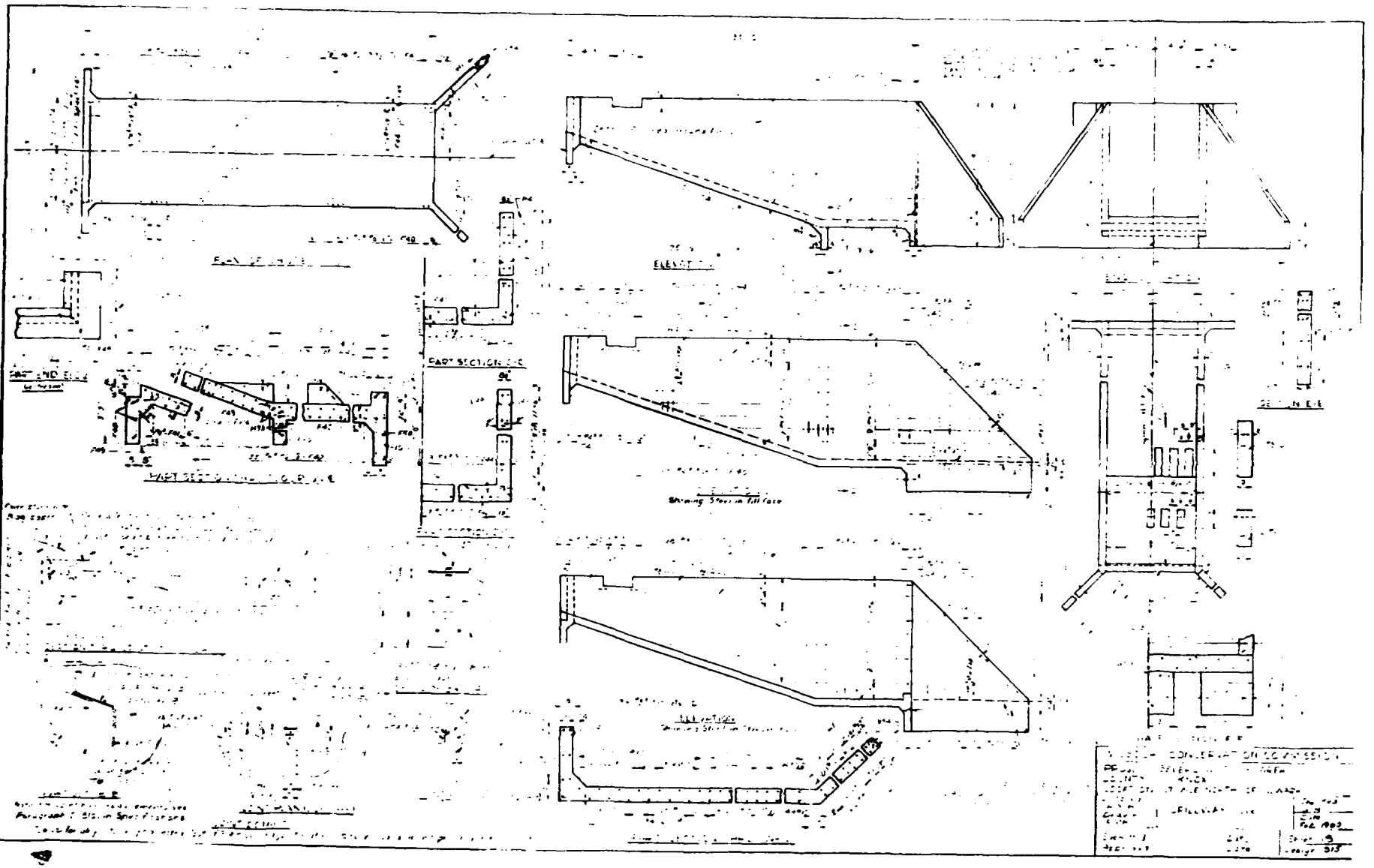
SHEET 18




FITTING
Diaphragm
Pipe Support
DETAILS OF DIAPHRAGM
DETAILS OF PIPE SUPPORT
QUANTITIES
7 Conc diaphragms @ 20'
PLAN of 15" LAKE DRAIN
SECTION AT LAKE DRAIN STA 6+21


Drop Channel 0.25' Per 100'



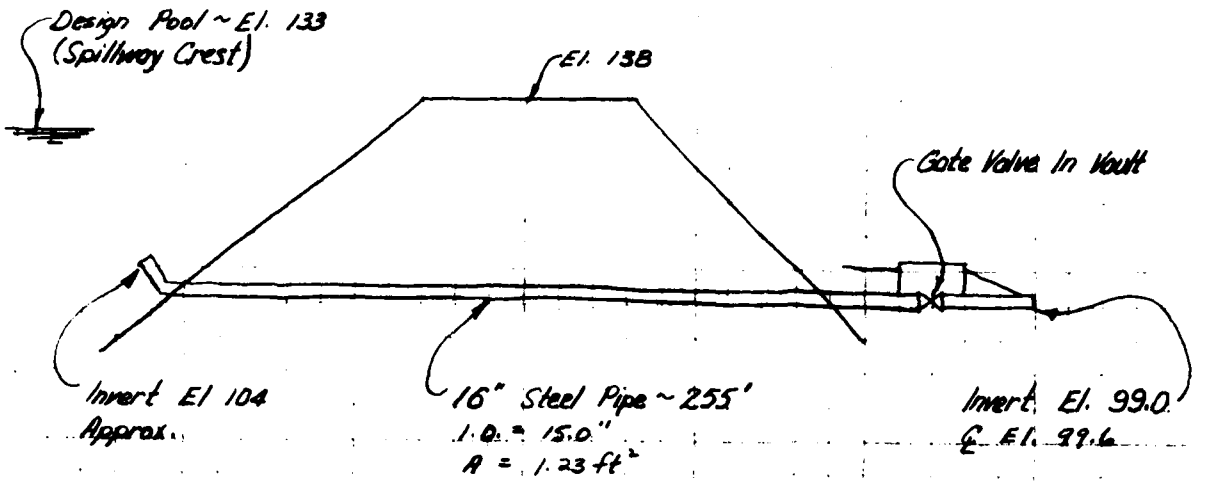
ENGINEERING CONSULTANTS, INC.

SEVER DAM - MISSOURI — SHEET NO. 1 OF

JOB NO. 1223

RATING CURVE FOR LOW LEVEL OUTLET — BY JCI DATE 10/19/78

NOTE: ELEV. 138 = ELEV. 688 M.S.L



Only significant losses are entrance loss, pipe friction, plus exit velocity head

Pipe friction

From Hyd. Institute Tables $F \cong 1.03$ where $h_f = F \frac{V^2}{2g}$ per 100'

Increase about 15% for ageing $F = 1.15 \times 1.03 \times \frac{255}{100} = 3.02$

$$h_f = 3.0 \frac{V^2}{2g}$$

Entrance Loss

Re-entrant type $K = 1.$

$$h_f = 1.0 \frac{V^2}{2g}$$

Exit Vel Head $= 1.0\ V^2/2g$

Total

3.0	$V^2/2g$	- Friction
1.0		- Entrance
1.0		- Outlet
5.0	$V^2/2g$	

ENGINEERING CONSULTANTS, INC.

SEVER DAM MISSOURI — SHEET NO. 2 OF ___

JOB NO. 1223

BY JCI DATE 10/10/78

$$H_{normal} = 5.0\, V^2/2g = 5\frac{Q^2}{A^2 \cdot 2g} = \frac{5Q^2}{(1.23)^2(2g)}$$

$$Q = 1.23\sqrt{\frac{2g \cdot H}{5}} = 4.4\sqrt{H} \quad CFS$$

El. - Ft	H - Ft	Q - CFS
108.6	9	13.2
115.6	16	17.6
129.6	25	22.0
135.6	36	26.4

Drawdown rate at design pool elevation

Surface area = 160 acres

time to drawdown one foot

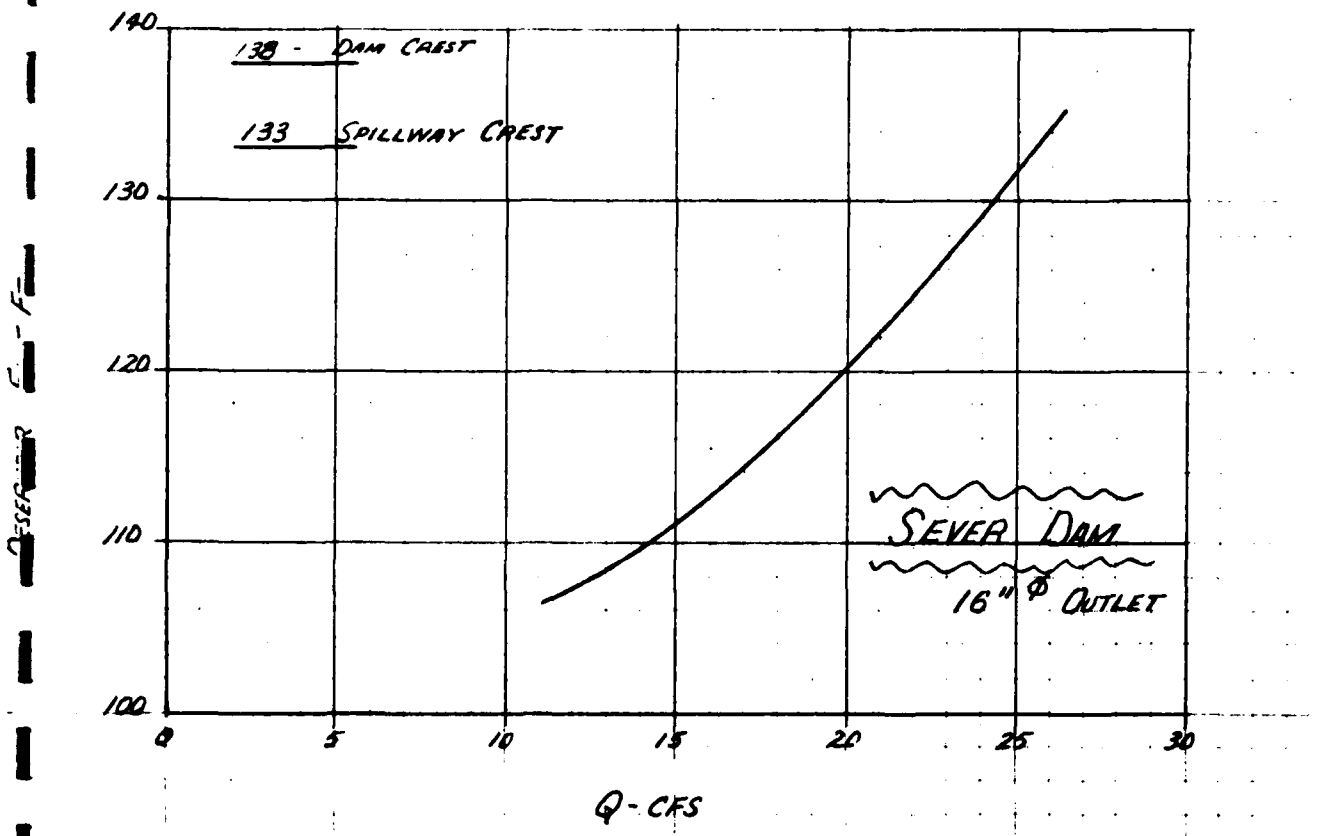
$$= \frac{160 \text{ acres} \times 43{,}560 \text{ ft}^2/\text{a}}{25.5 \text{ ft}^3/\text{sec} \times 60 \times 60 \times 24} = 3.16 \text{ days}$$

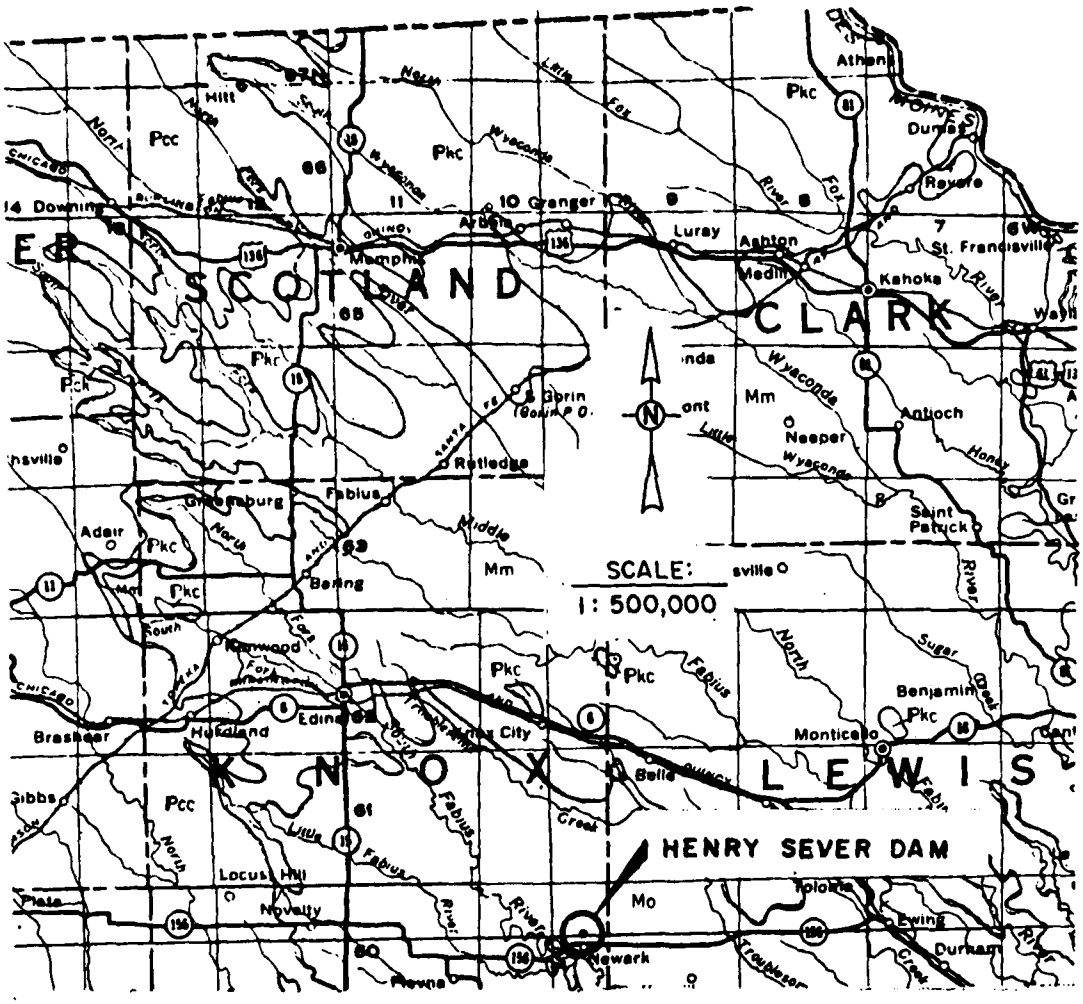
ENGINEERING CONSULTANTS, INC.

SEVER DAM MISSOURI — SHEET NO. 3 OF ____

JOB NO. 1223

OUTLET RATING CURVE — BY JCI DATE 10/10/78





Explanation

Pennsylvanian System

P_{kc} - Kansas City group: cyclic deposits with numerous limestones.
P_{pwm} - Pleasanton group: sandstone channel member.
P_{m} - Marmaton group: cyclic deposits with limestones.
P_{cc} - Cherokee group: cyclic deposits, predominately shale, sandstone and coal beds.

Mississippian System

M_{m} - sandy, oolitic, fossiliferous, lithographic, or cherty limestones.
M_{o} - cherty, crinoidal limestone, with some shale.
M_{k} - intercalated limestones and shales.

Reference: Geologic Map of Missouri, 1961, Division of Geological Survey and Water Resources, State of Missouri.

APPENDIX A

PHOTOGRAPHS TAKEN DURING INSPECTION

HENRY SEVER DAM

Photo 1 - View across grass-lined spillway and along crest of dam taken at left abutment.

Photo 2 - View across spillway approach channel for chute spillway and along crest of dam taken at right abutment.

Photo 3 - Picture of downstream slope of embankment taken from spillway chute.

Photo 4 - Picture of upstream embankment slope taken from near center of dam.

Photo 5 - Close-up of upstream embankment slope taken near left abutment. Note thin riprap and minor sloughing of embankment material.

Photo 6 - Picture of corrugated metal pit and top containing control gate.

Photo 7 - Picture of gate and handwheel in pit shown in previous picture.

Photo 8 - Picture of 16-inch I.D. steel discharge pipe for outlet works. Note corrugated metal pit to right of person.

Photo 9 - Picture of pool and channel downstream of outlet works discharge pipe.

Photo 10 - Picture of approach channel to chute spillway at right abutment. Note heavy vegetative growth in channel.

Photo 11 - Close-up of drop inlet to chute spillway.

Photo 12 - Picture of concrete chute and wingwalls on downstream embankment slope.

Photo 13 - View of pond and discharge channel for chute spillway.

Photo 14 - Picture of drop inlet and bridge over chute spillway. Note moisture in channel.

Photo 15 - Close-up of crack on wall of stilling basin.

Photo 16 - Close-up of leakage through construction joint between drop inlet and bridge section of chute spillway.

Photo 1 - View across grass-lined spillway and along crest of dam taken at left abutment.

Photo 2 - View across spillway approach channel for chute spillway and along crest of dam taken at right abutment.

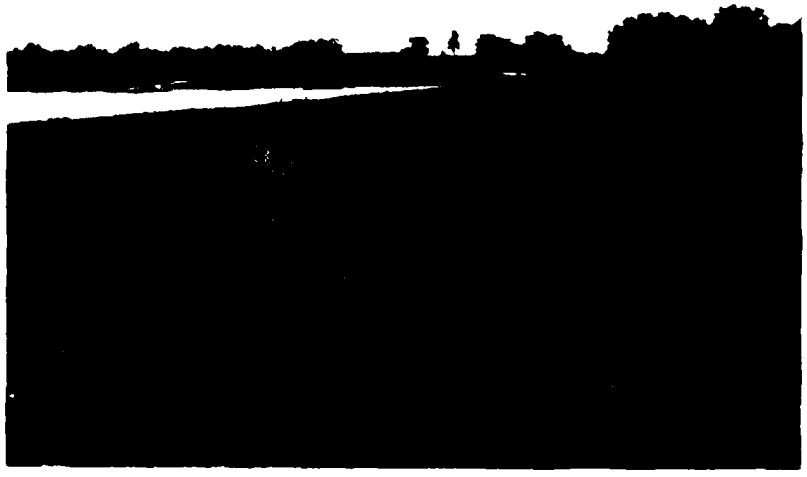


Photo 3 - Picture of downstream slope of embankment taken from spillway chute.

Photo 4 - Picture of upstream embankment slope taken from near center of dam.

Photo 5 - Close-up of upstream embankment slope taken near left abutment. Note thin riprap and minor sloughing of embankment material.

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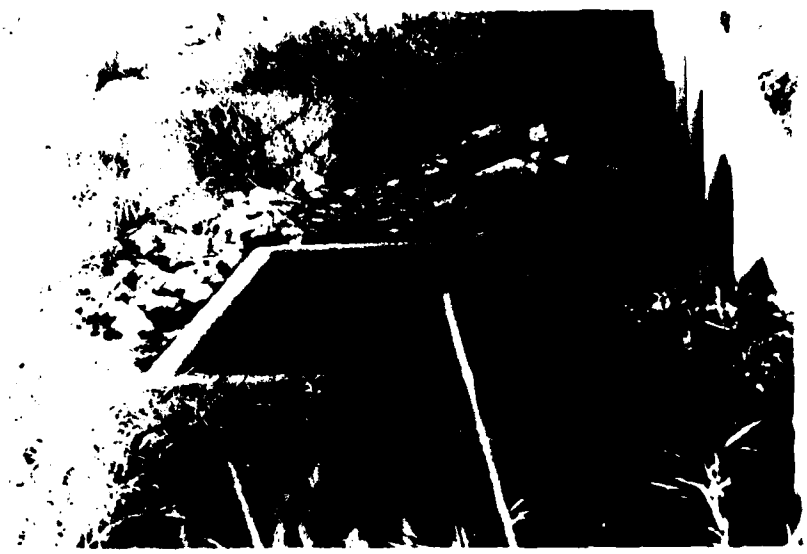


Photo 11 - Close-up of drop inlet to chute spillway.

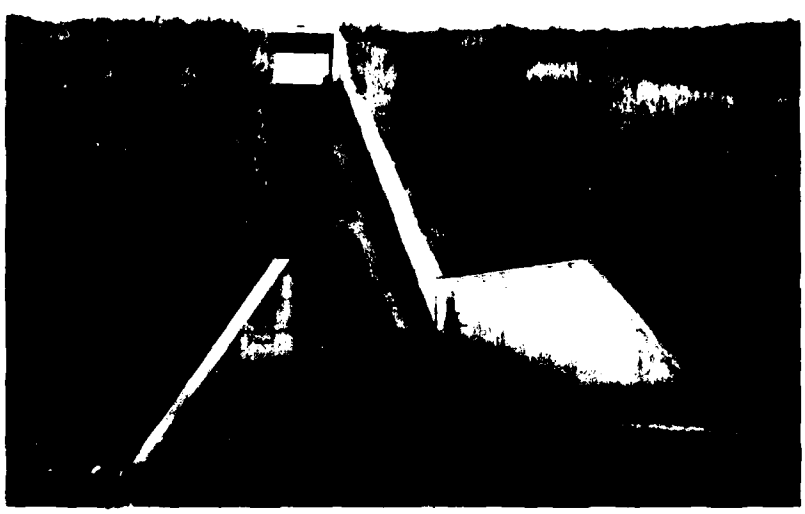


Photo 12 - Picture of concrete chute and wingwalls on downstream embankment slope.

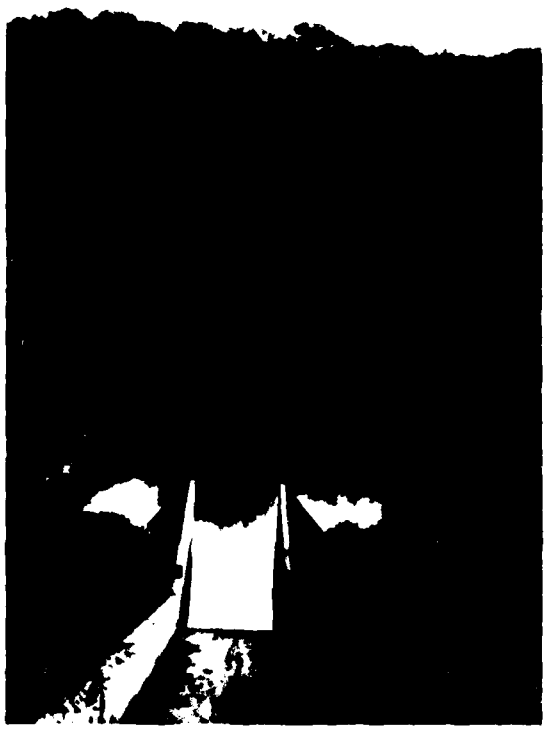


Photo 13 - View of pond and discharge channel for chute spillway.

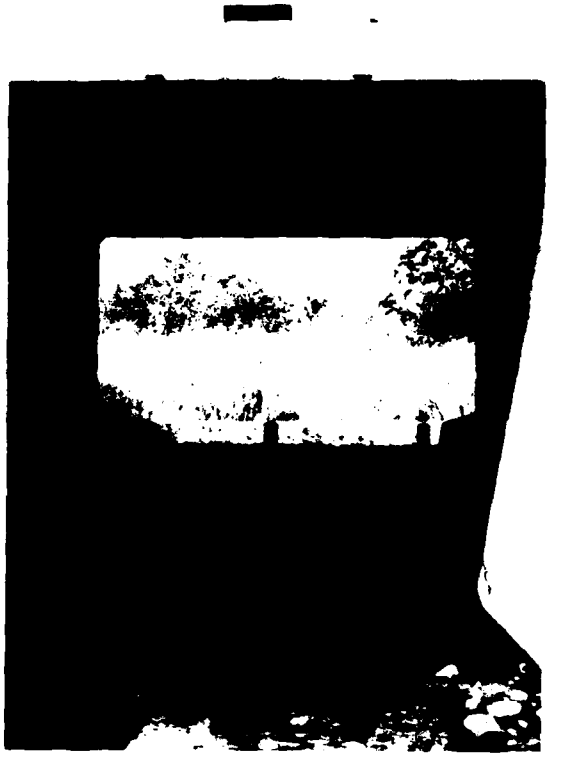


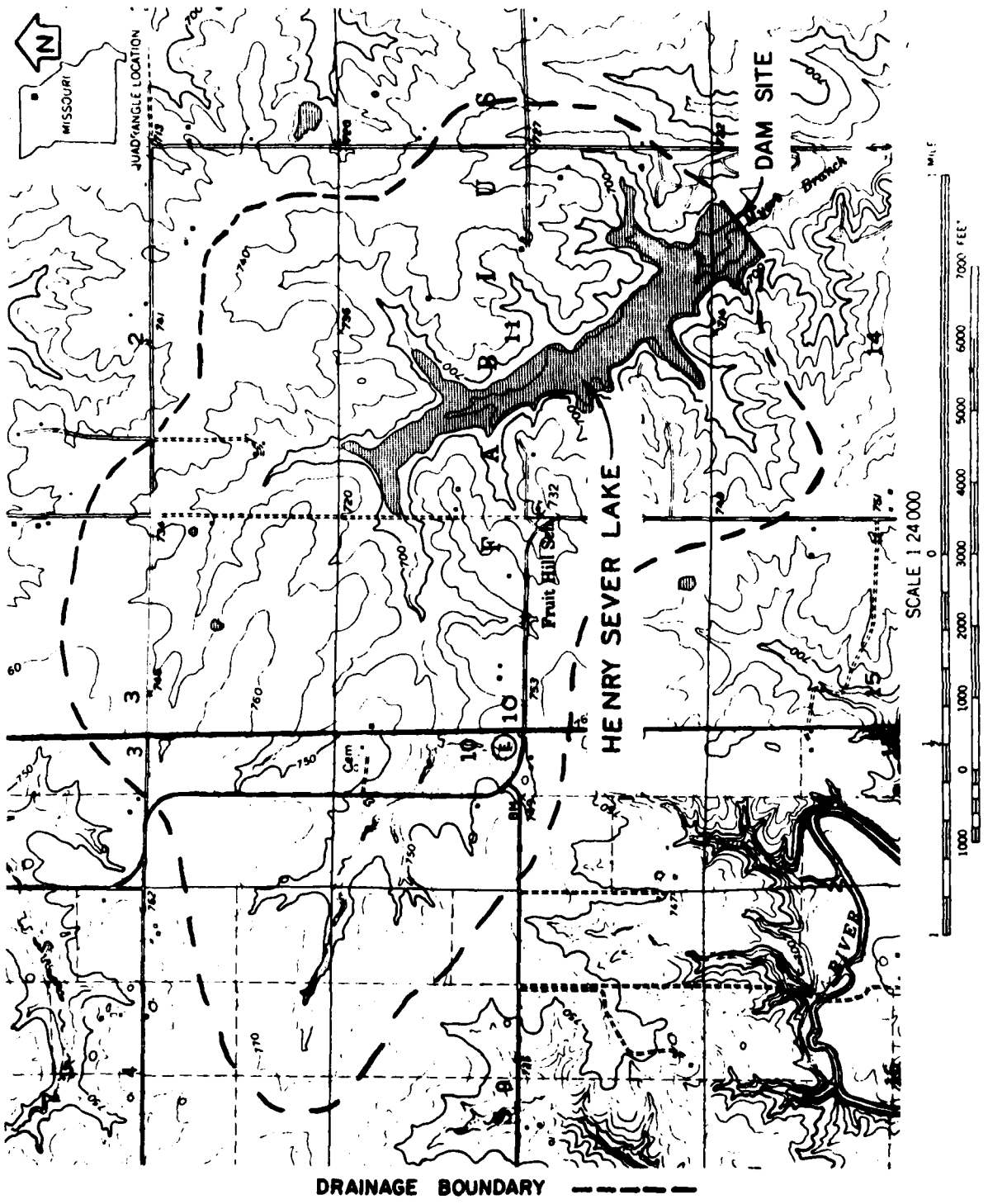
Photo 14 - Picture of drop inlet and bridge over chute spillway. Note moisture in channel.

Photo 15 - Close-up of crack on wall of stilling basin.

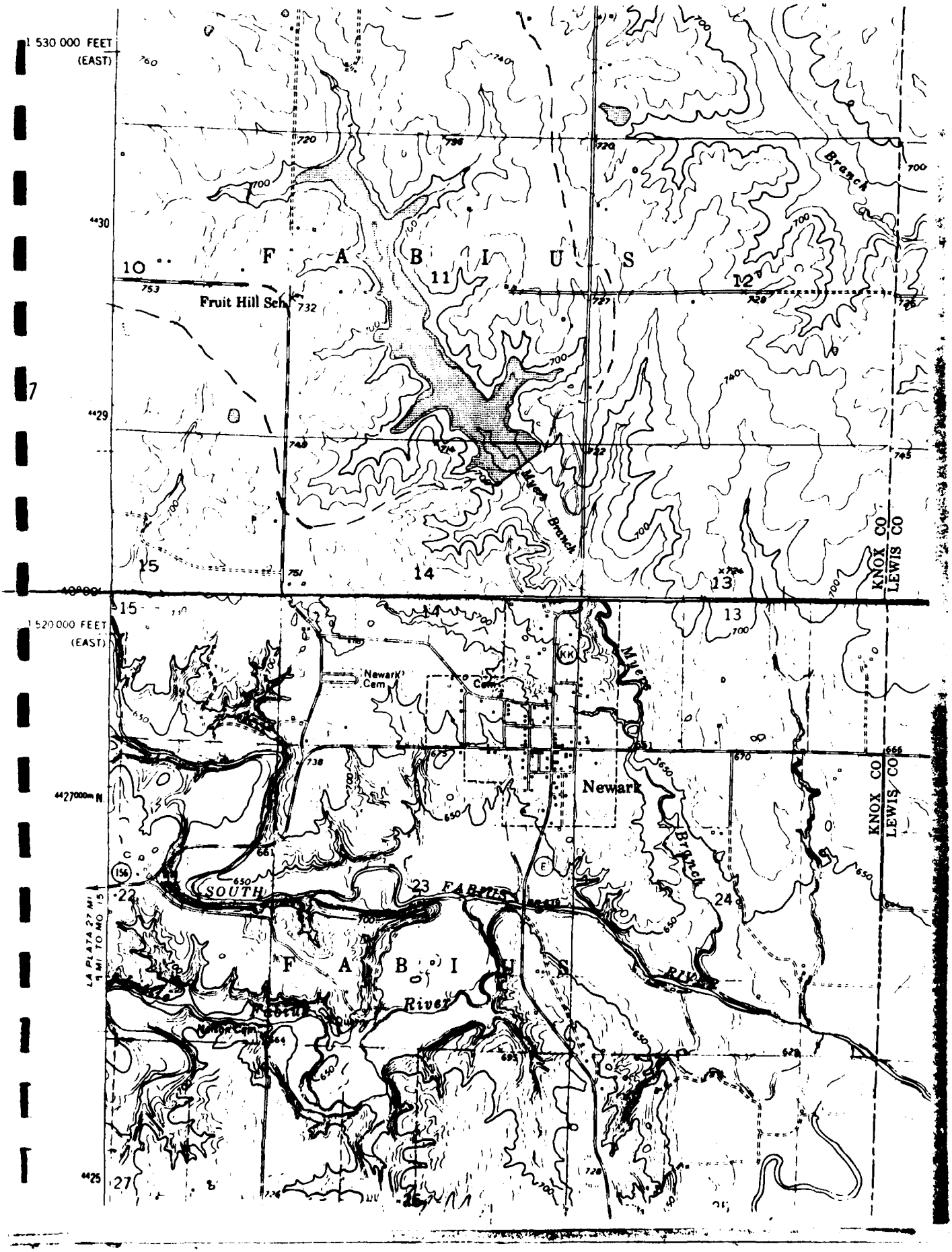
Photo 16 - Close-up of leakage through construction joint between drop inlet and bridge section of chute spillway.

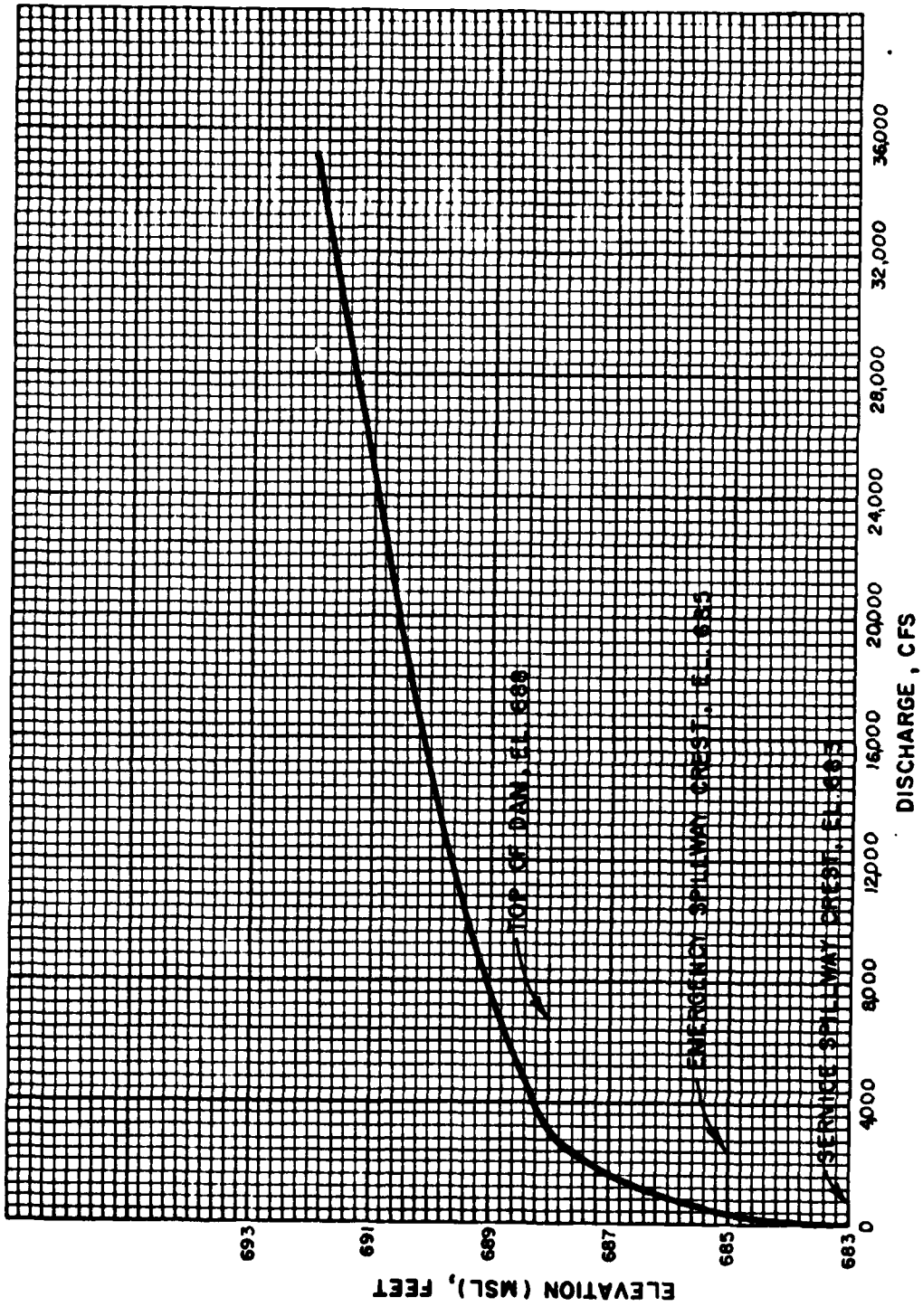
APPENDIX B

HYDROLOGIC COMPUTATIONS

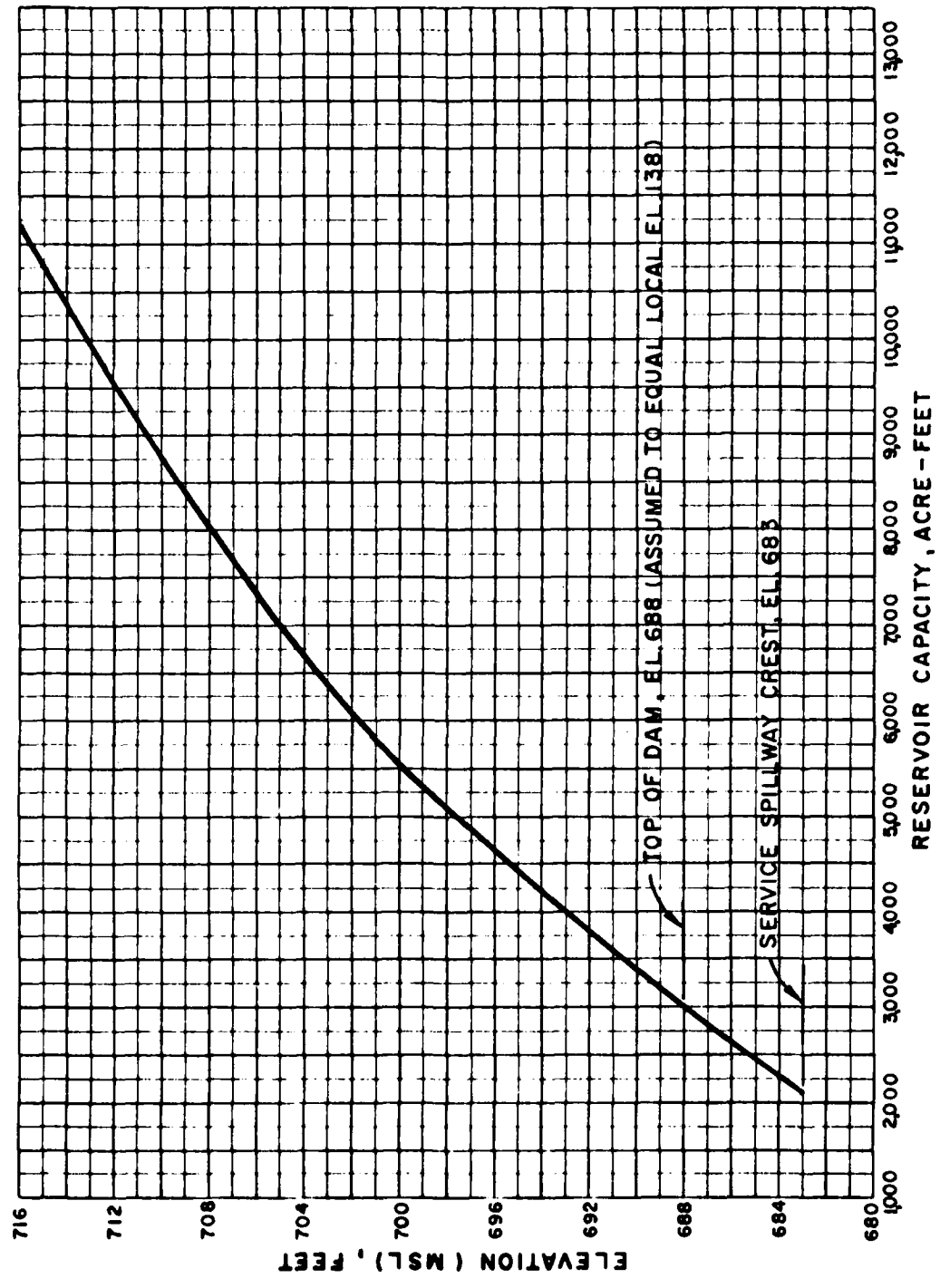


HENRY SEVER DAM
DRAINAGE BASIN


1 530 000 FEET
(EAST)
F A B I U S
Fruit Hill Sch
Branch
Myers Branch
KNOX CO
LEWIS CO
1 520 000 FEET
(EAST)
Newark Cem
Newark
Branch
SOUTH
FABIUS
RIVER
F A B I U S
River
Fabius
LA PLATA 27 MI
1 MI TO MO 15
4427000m N



HENRY SEVER DAM
SPILLWAY & OVERTOP RATING CURVE



HENRY SEVER DAM
RESERVOIR CAPACITY CURVE

ECI-4 ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION / MISSOURI — SHEET NO. 1 OF 2
HENRY SEVER DAM — JOB NO. 1223-001
RESERVOIR AREA CAPACITY — BY MAS DATE 10-6-78

HENRY SEVER DAM

RESERVOIR AREA CAPACITY

Elev. MSL (Ft.)	Surface area (Acres)	Incremental Volume (AF.)	Total Volume (AF)	Remarks
683	158		2,106	Local elev 183 is assumed to correspond to MSL elev. of 683.
688	200	895	3,001	Top of dam
700	222	2532	5,533	
720	514	7360	12,893	

The data used are based on the USGS Labelle Quadrangle sheet (7.5 minute series) in combination with data given in the National Dam Safety Inventory Table.

ECI-4 ENGINEERING CONSULTANTS, INC.

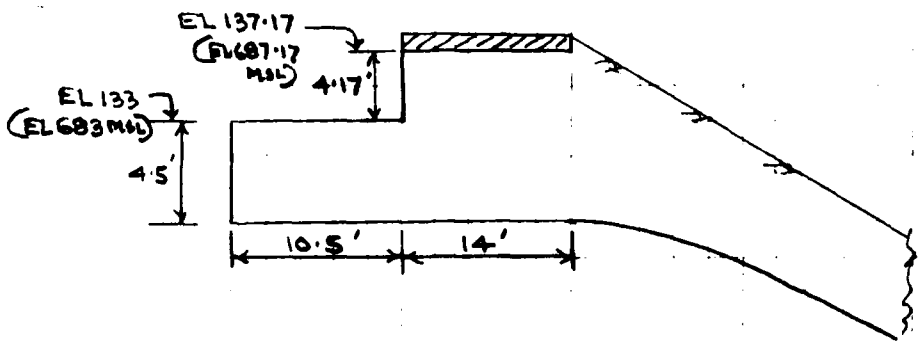
DAM SAFETY INSPECTION / MISSOURI — SHEET NO. 1 OF 7

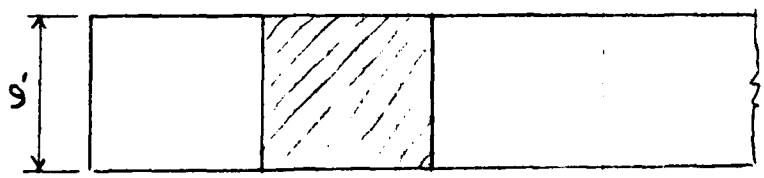
HENRY SEVER DAM — JOB NO. 1223-001

SPILLWAYS & OVERTOP DISCHARGE CAPACITY — BY MAS Cim — DATE 10-6-78

HENRY SEVER DAM

A. SPILLWAY DISCHARGE CAPACITY





W.S. EL @ 684

a. Q by weir equation

$$Q = CLH^{1.5}$$

$$= 3.14 \times 30 \times 1^{1.5}$$

$$= 94.2 \text{ cfs}$$

b. Q by critical flow computation

$$y_c = \frac{2}{3}H = \frac{2}{3} \times 5.5$$

$$= 3.67$$

$$V_c = \sqrt{g y_c} = \sqrt{32.2 \times 3.67'}$$

$$= 10.87 \text{ ft/sec}$$

$$Q_c = A V_c = 3.67' \times 9' \times 10.87$$

$$= 359.04 > Q \text{ by weir Equation.}$$

∴ Actual $Q = 94$ cfs.

W.S. EL @ 685

a. Q by weir Eq:

$$Q = 3.31 \times 30 \times 2^{1.5}$$

$$= 280.86 \text{ cfs}$$

b. Q by critical flow computation is > Q by weir Equation (By observation)

∴ Actual $Q = 281$ cfs

W.S. EL @ 686.48

a. Q by weir Eq.

$$Q = 3.32 \times 30 \times 3.48^{1.5} = 647 \text{ cfs.}$$

b. Q by critical flow computation:

$$y_c = \frac{2}{3} \times 7.98 = 5.35'$$

$$V_c = \sqrt{g y_c} = \sqrt{32.2 \times 5.35} = 13.12 \text{ ft/sec}$$

$Q_c = AV_c = 5.35 \times 9 \times 13.12$

$= 632$ cfs $<$ 647 cfs

Actual $Q = 632$ cfs

W.S. EL @ 687:

a. Q by Weir Eq.

$Q = 3.32 \times 30 \times 4^{1.5}$

$= 797$ cfs

b. Q by critical flow computation:

$y_c = \frac{2}{3} \times 8.5 = 5.67$ ft

$V_c = \sqrt{g y_c} = 13.51$ ft/sec

$Q_c = 5.67 \times 9 \times 13.51 = 690$ cfs.

Actual $Q =$ 690 cfs

W.S. EL @ 687.92

a. Q by Weir Eq.

$Q = 3.32 \times 30 \times 4.92^{1.5} = 1087$ cfs

b. Q by critical flow computation

$V_c = \sqrt{g y_c} = \sqrt{32.2 \times .67 \times 9.42} = 14.26$ ft/sec.

$Q_c = 9 \times 6.31 \times 14.26 = 810$ cfs.

c. Q by Orifice Eq.

$$Q_o = CA\sqrt{2gH_o}$$
$$= 0.6 \times 9 \times 8.67 \times \sqrt{64.4 \times 7.17}$$
$$= 1006 \text{ cfs.}$$

Actual $Q = 1006$ cfs

Use orifice Equation for W.L @ EL 1382 above.

W.S. El @ 689.32

$$Q = CA\sqrt{2gH_o}$$
$$= 0.6 \times 9 \times 8.67 \sqrt{64.4 \times 8.57} = 46.82\sqrt{64.4 \times 8.57}$$
$$= 1100 \text{ cfs}$$

W.S El @ 690.77

$$Q = 46.82\sqrt{64.4 \times 10.02}$$
$$= 1189 \text{ cfs}$$

W.S. EL @ 692.19

$$Q = 46.82\sqrt{64.4 \times 11.44}$$
$$= 1271 \text{ cfs}$$

ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION / MISSOURI — SHEET NO. 5 OF 7

HENRY SEVER DAM — JOB NO. 1223-001

SPILLWAYS & OVERTOP DISCHARGE CAPACITY — BY MAS — DATE 10-9

15. OVERTOP & EMERGENCY SPILLWAY DISCHARGES

Y_c	T_c	A_c	Y_c = 5.67 $\sqrt{A_c/T_c}$	$\frac{V_c^2}{2g}$	U/S W.S. elev. = $Y_c + \frac{V_c^2}{2g}$	Q_c	L_D	H_D	C_D	Q_D = $C_D H_D^{1.5} L_D$	$Q_T = Q_c + Q_D$
1	110	105	5.54	0.48	1.48 (686.48)	582					582
2	120	220	7.68	0.92	2.92 (687.92)	1690					1690
3	130	345	9.24	1.32	4.32 (689.32)	3188	1170	1.32	2.64	4684	7872
4	135	477.5	10.66	1.77	5.77 (690.77)	5090	1170	2.77	2.64	14240	19330
5	140	615.0	11.88	2.19	7.19 (692.19)	7306	1170	4.19	2.64	26492	33,798

ECI-4 ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION/MISSOURI — SHEET NO. 6 OF 7
HENRY SEVER DAM — JOB NO. 1223-001
SPILLWAYS & OVERTOP DISCHARGE CAPACITY — BY MAS DATE 10-13-78

Upstream Water Surface Elev. (feet)	Discharge through the Spillway (cfs)	Discharge through emergency Spillway & over top of dam (cfs)	Total discharge (cfs)
133 (683 MSL)	0	0	0
134 (684 MSL)	94	0	94
135 (685 ")	281	0	281
136.48 (686.48 ")	632	582	1,214
137.92 (687.92 ")	1006	1690	2,696
139.32 (689.32 ")	1100	7872	8,972
140.77 (690.77 ")	1189	19330	20,519
142.19 (692.19 ")	1271	33798	35,069

ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION – MISSOURI — SHEET NO. 1 OF
HENERY SEVER DAM — JOB NO. 1223-001-1
UNIT HYDROGRAPH PARAMETERS — BY KLB DATE 10-6-78

1 DRAINAGE AREA = 3.13 SQ. MI.

2. LENGTH OF STREAM = L = (9.6" * 2000')/5280' = 1.74 MI

3. DIFFERENCE IN ELEVATION: ΔH

$\Delta H = 775 - 683 = 92$ FT.

4. TIME OF CONCENTRATION

$$T_c = \left(\frac{11.9 * L^3}{\Delta H}\right)^{0.385} = \left(\frac{11.9 * 1.74^3}{92}\right)^{0.385}$$

$T_c = 0.86$ HR

5. LAG TIME = $L_t = 0.6 * T_c$

$L_t = 0.6 * 0.86 = 0.52$ HR

6 UNIT DURATION

$D \leq \frac{L_t}{4} = \frac{0.52}{4} = 0.13$

USE $D = 0.10$

7. TIME TO PEAK

$T_p = \frac{D}{2} + 0.6 * T_c$

$= \frac{0.10}{2} + 0.6 * 0.86$

$T_p = 0.57$

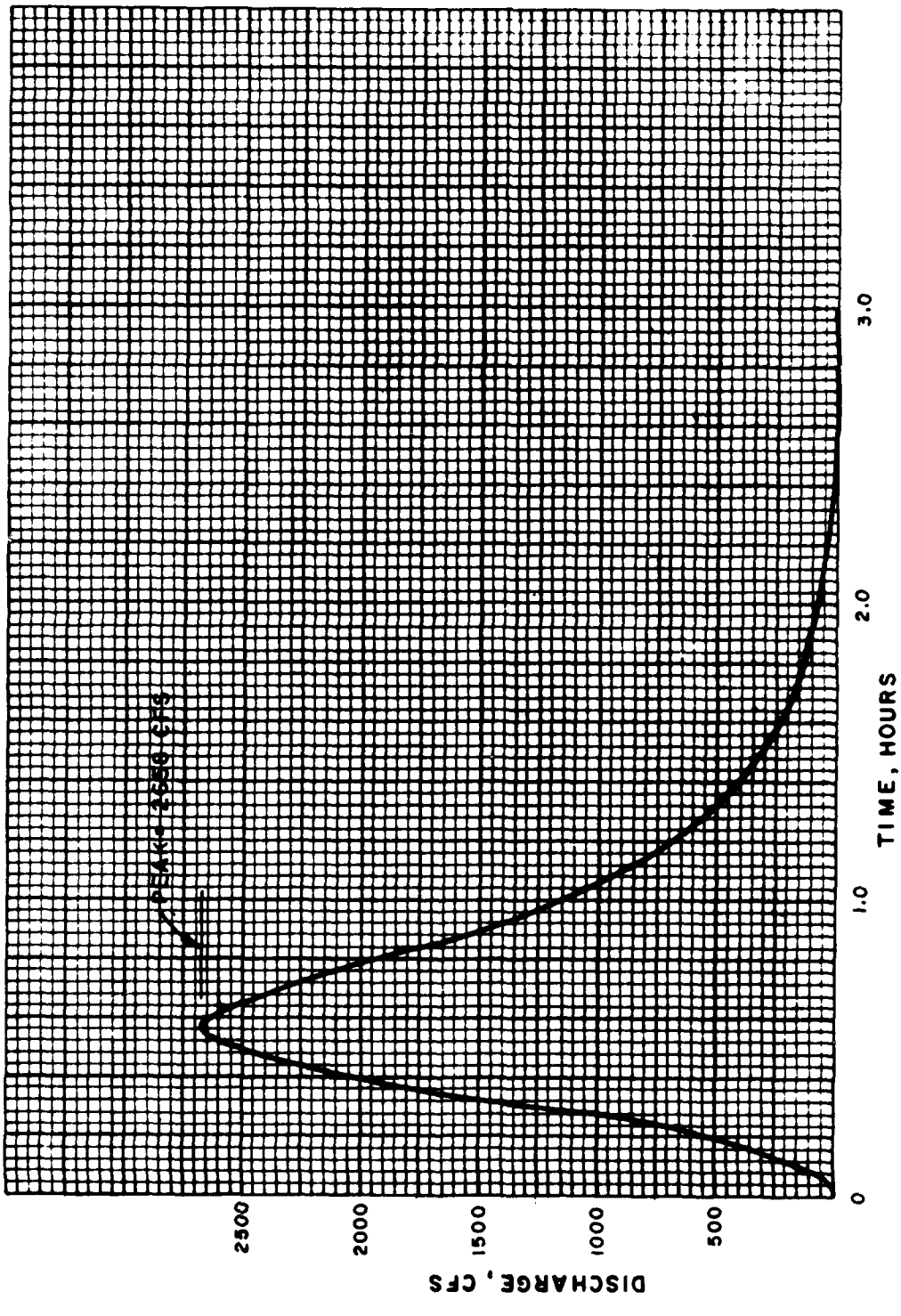
8. $q_p = \frac{484 \cdot A}{T_p} = \frac{484 * 3.13}{0.57} = 2657.75$ CFS

ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION - MISSOURI — SHEET NO. 2 OF ____
HENRY SEVER DAM — JOB NO. 1223-001-1
UNIT HYDROGRAPH DERIVATION — BY KLB DATE 10-6-78

1) CURVILINEAR UNIT HYDROGRAPH

TIME T/Tp	DISCHARGE RATIO q/qp	UNIT HYDROGRAPH	
		TIME, T (HOURS)	DISCHARGE (CFS)
0.0	0.000	0.00	0.00
0.1	0.015	0.06	32.87
0.2	0.075	0.11	199.33
0.3	0.16	0.17	425.24
0.4	0.28	0.23	744.17
0.5	0.45	0.29	1195.99
0.6	0.60	0.34	1594.65
0.7	0.77	0.40	2046.47
0.8	0.89	0.46	2365.40
0.9	0.97	0.51	2578.02
1.0	1.00	0.57	2657.75
1.1	0.98	0.63	2604.60
1.2	0.92	0.68	2445.13
1.3	0.84	0.74	2232.51
1.4	0.75	0.80	1993.31
1.5	0.66	0.86	1754.12
1.6	0.56	0.91	1488.39
1.8	0.42	1.03	1116.26
2.0	0.32	1.14	850.48
2.2	0.24	1.25	637.86
2.4	0.18	1.37	478.40
2.6	0.13	1.48	345.51
2.8	0.098	1.60	260.46
3.0	0.075	1.71	199.33
3.5	0.036	2.00	95.68
4.0	0.018	2.28	47.84
4.5	0.009	2.57	23.92
5.0	0.004	2.85	10.63
			2050



HENRY SEVER DAM
0.10 HOUR UNIT HYDROGRAPH

HENRY SEVER DAM

DETERMINATION OF PMS

1. Determine drainage area of the basin:

   D.A. = 2000 Acres = 3.13 Sq. Mi

2. Determine PMP Index Rainfall:

   Location of Centroid of basin:

   Long. 91°59.25' ; Lat 40°1.22'

   ⇒ PMP for 200 Sq. Mi & 24 hrs duration = 24" (from Fig. 1, HMR № 38)

3. Determine basin rainfall interms of percentage of PMP Index Rainfall for various durations:

   Location Long 91°59.25' ; Lat. 40°1.22'

   ⇒ Zone 7.

Duration (Hrs)	Percent of Index Rainfall (%)	Total rainfall (inches)	Rainfall increments (inches)	Duration of increment (Hrs)
6	100	24	24	6
12	120	28.8	4.8	6
24	130	31.2	2.4	12

ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION / MISSOURI — SHEET NO. 1 OF
HENRY SEVER DAM — JOB NO. 1223-001
100-YEAR FLOOD BY REGRESSION EQUATION — BY MAS — DATE 10-16-78

HENRY SEVER DAM

100 YEAR FLOOD

Regression equation for 100-year flood for MISSOURI :-

$$Q_{100} = 85.1 A^{0.934 A^{-0.02}} S^{0.576}$$

where A = drainage area in Sq. mi

S = main channel slope ft/mi (Avg. slope between 0.1L & 0.85L)

For Henry Sever Dam

$A = 3.13$ Sq. mi.

$S = 61 \text{ ft} / 1.31 \text{ mi} = 46.56$ ft/mi

$$\therefore Q_{100} = 85.1 (3.13)^{0.934 (3.13)^{-0.02}} (46.56)^{0.576}$$

$$= 2203 \text{ cfs}$$

HEC1DB INPUT DATA

```
*********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  3 AUG 78
*********************************
     1          A                    DAM SAFETY INSPECTION - MISSOURI
     2          A                          HENRY SEVER DAM
     3          A              PMF AND 50 PERCENT OF PMF DETERMINATION AND ROUTING
     4          B     300       0       0       0       0       0       0       0       0       0
     5          B1      5
     6          J       1       2       1
     7          J1    1.0     0.5
     8          K       0       1                                       1
     9          K1      INPUT PMP INDEX PRECIPITATION AND RATIOS, INPUT SCS UNIT HYDROGRAPH
    10          M       1      -1    3.13            3.13     1.0
    11          P            24.0     100     120     130
    12          T                                                     0.85    0.07
    13          U      30
    14          U1    0.0     135.    550.   1200.   2040.   2530.   2658.   2360.   1980.   1550.
    15          U1  1210.     940.    710.    550.    430.    325.    260.    200.    160.    125.
    16          U1   100.      80.     60.     45.     30.     20.     15.     10.      5.      0.
    17          X               0       1
    18          K       1       1                       2                       1
    19          K1       ROUTE HYDROGRAPH THROUGH HENRY SEVER DAM
    20          Y                                   1       1
    21          Y1      1                                                   -683.      -1
    22          Y4683.00  684.00  685.00  686.48  687.92  689.32  690.77  692.19
    23          Y5     0.     94.    281.   1214.   2696.   8972.  20519.  35069.
    24          $S 2106.   3001.   4000.   5533.  12893.
    25          $E683.00  688.00  693.00  700.00  720.00
    26          $S683.00
    27          $D688.00
    28          K      99
```

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT 1
ROUTE HYDROGRAPH TO 1
END OF NETWORK

INFLOW PMF AND ONE-HALF PMF HYDROGRAPHS

```
**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  3 AUG 78
**********************************

RUN  DATE= 78/10/24.
     TIME= 13.03.53.
```

DAM SAFETY INSPECTION - MISSOURI
HENRY SEVER DAM
PMF AND 50 PERCENT OF PMF DETERMINATION AND ROUTING

JOB SPECIFICATION

NO	NHR	NMIN	IDAY	IHR	IMIN	METRIC	IPLT	IPRT	ISTAG
300	0	0	0	0	0	0	0	0	0

JOPER	NAT	IHYDPT	ITRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 2 LRTIO= 1

RTIOS= 1.00 .50

********** *********** ********** ********* **********

SUB-AREA RUNOFF COMPUTATION

INPUT PMP INDEX PRECIPITATION AND RATIOS, INPUT SCS UNIT

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISAME	LOCAL
1	-1	3.15	0.00	3.15	1.00	0.000	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	24.00	100.00	120.00	130.00	0.00	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	.85	.07	0.00	0.00

GIVEN UNIT GRAPH, NUNGG= 3.

0.	135.	550.	1200.	2040.	2530.	2658.	2380.	1980.	1550.
1210.	940.	710.	550.	430.	325.	260.	200.	160.	125.
100.	80.	60.	45.	30.	20.	15.	10.	5.	0.

UNIT GRAPH TOTALS 20298. CFS OR 1.01 INCHES OVER THE AREA

RECESSION DATA

STRTQ= 0.00 QRCSN= 0.00 RTIOR= 1.00

0 END-OF-PERIOD FLOW

MO,DA	HR,MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO,DA	HR,MN	PERIOD	RAIN	EXCS	LOSS	COMP Q

1.01	.06	1	.02	0.00	.02	0.	1.01	15.06	151	.36	.36	.01	6860.
1.01	.12	2	.02	0.00	.02	0.	1.01	15.12	152	.46	.45	.01	6932.
1.01	.18	3	.02	0.00	.02	0.	1.01	15.18	153	.55	.54	.01	7001.
1.01	.24	4	.02	0.00	.02	0.	1.01	15.24	154	.73	.72	.01	7111.
1.01	.30	5	.02	0.00	.02	0.	1.01	15.30	155	1.64	1.63	.01	7337.
1.01	.36	6	.02	0.00	.02	0.	1.01	15.36	156	2.92	2.91	.01	7893.
1.01	.42	7	.02	0.00	.02	0.	1.01	15.42	157	.91	.91	.01	9235.
1.01	.48	8	.02	0.00	.02	0.	1.01	15.48	158	.73	.72	.01	11632.
1.01	.54	9	.02	0.00	.02	0.	1.01	15.54	159	.46	.45	.01	14839.
1.01	1.00	10	.02	0.00	.02	0.	1.01	16.00	160	.36	.36	.01	18105.
1.01	1.06	11	.02	0.00	.02	0.	1.01	16.06	161	.34	.33	.01	20053.
1.01	1.12	12	.02	0.00	.02	0.	1.01	16.12	162	.34	.33	.01	20410.
1.01	1.18	13	.02	0.00	.02	0.	1.01	16.18	163	.34	.33	.01	19263.
1.01	1.24	14	.02	0.00	.02	0.	1.01	16.24	164	.34	.33	.01	17409.
1.01	1.30	15	.02	0.00	.02	0.	1.01	16.30	165	.34	.33	.01	15359.
1.01	1.36	16	.02	0.00	.02	0.	1.01	16.36	166	.34	.33	.01	13545.
1.01	1.42	17	.02	0.00	.02	0.	1.01	16.42	167	.34	.33	.01	12019.
1.01	1.48	18	.02	0.00	.02	0.	1.01	16.48	168	.34	.33	.01	10780.
1.01	1.54	19	.02	0.00	.02	0.	1.01	16.54	169	.34	.33	.01	9852.
1.01	2.00	20	.02	0.00	.02	0.	1.01	17.00	170	.34	.33	.01	9133.
1.01	2.06	21	.02	0.00	.02	0.	1.01	17.06	171	.26	.26	.01	8570.
1.01	2.12	22	.02	0.00	.02	0.	1.01	17.12	172	.26	.26	.01	8152.
1.01	2.18	23	.02	0.00	.02	0.	1.01	17.18	173	.26	.26	.01	7784.
1.01	2.24	24	.02	0.00	.02	0.	1.01	17.24	174	.26	.26	.01	7454.
1.01	2.30	25	.02	0.00	.02	0.	1.01	17.30	175	.26	.26	.01	7112.
1.01	2.36	26	.02	0.00	.02	0.	1.01	17.36	176	.26	.26	.01	6780.
1.01	2.42	27	.02	0.00	.02	0.	1.01	17.42	177	.26	.26	.01	6466.
1.01	2.48	28	.02	0.00	.02	0.	1.01	17.48	178	.26	.26	.01	6188.
1.01	2.54	29	.02	0.00	.02	0.	1.01	17.54	179	.26	.26	.01	5957.
1.01	3.00	30	.02	0.00	.02	0.	1.01	18.00	180	.26	.26	.01	5771.
1.01	3.06	31	.02	0.00	.02	0.	1.01	18.06	181	.02	.02	.01	5630.
1.01	3.12	32	.02	0.00	.02	0.	1.01	18.12	182	.02	.02	.01	5493.
1.01	3.18	33	.02	0.00	.02	0.	1.01	18.18	183	.02	.02	.01	5280.
1.01	3.24	34	.02	0.00	.02	0.	1.01	18.24	184	.02	.02	.01	4926.
1.01	3.30	35	.02	0.00	.02	0.	1.01	18.30	185	.02	.02	.01	4387.
1.01	3.36	36	.02	0.00	.02	0.	1.01	18.36	186	.02	.02	.01	3751.
1.01	3.42	37	.02	0.00	.02	0.	1.01	18.42	187	.02	.02	.01	3092.
1.01	3.48	38	.02	0.00	.02	0.	1.01	18.48	188	.02	.02	.01	2585.
1.01	3.54	39	.02	0.00	.02	0.	1.01	18.54	189	.02	.02	.01	2018.
1.01	4.00	40	.02	0.00	.02	0.	1.01	19.00	190	.02	.02	.01	1637.
1.01	4.06	41	.02	0.00	.02	0.	1.01	19.06	191	.02	.02	.01	1340.
1.01	4.12	42	.02	0.00	.02	0.	1.01	19.12	192	.02	.02	.01	1108.
1.01	4.18	43	.02	0.00	.02	0.	1.01	19.18	193	.02	.02	.01	934.
1.01	4.24	44	.02	0.00	.02	0.	1.01	19.24	194	.02	.02	.01	798.
1.01	4.30	45	.02	0.00	.02	0.	1.01	19.30	195	.02	.02	.01	693.
1.01	4.36	46	.02	0.00	.02	0.	1.01	19.36	196	.02	.02	.01	614.
1.01	4.42	47	.02	0.00	.02	0.	1.01	19.42	197	.02	.02	.01	550.
1.01	4.48	48	.02	0.00	.02	0.	1.01	19.48	198	.02	.02	.01	501.
1.01	4.54	49	.02	0.00	.02	0.	1.01	19.54	199	.02	.02	.01	463.
1.01	5.00	50	.02	0.00	.02	0.	1.01	20.00	200	.02	.02	.01	433.
1.01	5.06	51	.02	0.00	.02	0.	1.01	20.06	201	.02	.02	.01	409.
1.01	5.12	52	.02	0.00	.02	0.	1.01	20.12	202	.02	.02	.01	389.
1.01	5.18	53	.02	0.00	.02	0.	1.01	20.18	203	.02	.02	.01	375.
1.01	5.24	54	.02	.01	.01	0.	1.01	20.24	204	.02	.02	.01	364.
1.01	5.30	55	.02	.01	.01	1.	1.01	20.30	205	.02	.02	.01	357.
1.01	5.36	56	.02	.01	.01	6.	1.01	20.36	206	.02	.02	.01	352.
1.01	5.42	57	.02	.01	.01	16.	1.01	20.42	207	.02	.02	.01	349.
1.01	5.48	58	.02	.01	.01	33.	1.01	20.48	208	.02	.02	.01	346.
1.01	5.54	59	.02	.01	.01	55.	1.01	20.54	209	.02	.02	.01	345.
1.01	6.00	60	.02	.01	.01	79.	1.01	21.00	210	.02	.02	.01	345.

1.01	6.06	61	.08	.07	.01	101.	1.01	21.06	211	.02	.02	.01	345.
1.01	6.12	62	.08	.07	.01	128.	1.01	21.12	212	.02	.02	.01	345.
1.01	6.18	63	.08	.07	.01	177.	1.01	21.18	213	.02	.02	.01	345.
1.01	6.24	64	.08	.07	.01	265.	1.01	21.24	214	.02	.02	.01	345.
1.01	6.30	65	.08	.07	.01	405.	1.01	21.30	215	.02	.02	.01	345.
1.01	6.36	66	.08	.07	.01	573.	1.01	21.36	216	.02	.02	.01	345.
1.01	6.42	67	.08	.07	.01	749.	1.01	21.42	217	.02	.02	.01	345.
1.01	6.48	68	.08	.07	.01	905.	1.01	21.48	218	.02	.02	.01	345.
1.01	6.54	69	.08	.07	.01	1035.	1.01	21.54	219	.02	.02	.01	345.
1.01	7.00	70	.08	.07	.01	1136.	1.01	22.00	220	.02	.02	.01	345.
1.01	7.06	71	.08	.07	.01	1216.	1.01	22.06	221	.02	.02	.01	345.
1.01	7.12	72	.08	.07	.01	1277.	1.01	22.12	222	.02	.02	.01	345.
1.01	7.18	73	.08	.07	.01	1324.	1.01	22.18	223	.02	.02	.01	345.
1.01	7.24	74	.08	.07	.01	1360.	1.01	22.24	224	.02	.02	.01	345.
1.01	7.30	75	.08	.07	.01	1388.	1.01	22.30	225	.02	.02	.01	345.
1.01	7.36	76	.08	.07	.01	1410.	1.01	22.36	226	.02	.02	.01	345.
1.01	7.42	77	.08	.07	.01	1427.	1.01	22.42	227	.02	.02	.01	345.
1.01	7.48	78	.08	.07	.01	1440.	1.01	22.48	228	.02	.02	.01	345.
1.01	7.54	79	.08	.07	.01	1450.	1.01	22.54	229	.02	.02	.01	345.
1.01	8.00	80	.08	.07	.01	1458.	1.01	23.00	230	.02	.02	.01	345.
1.01	8.06	81	.08	.07	.01	1465.	1.01	23.06	231	.02	.02	.01	345.
1.01	8.12	82	.08	.07	.01	1470.	1.01	23.12	232	.02	.02	.01	345.
1.01	8.18	83	.08	.07	.01	1474.	1.01	23.18	233	.02	.02	.01	345.
1.01	8.24	84	.08	.07	.01	1477.	1.01	23.24	234	.02	.02	.01	345.
1.01	8.30	85	.08	.07	.01	1479.	1.01	23.30	235	.02	.02	.01	345.
1.01	8.36	86	.08	.07	.01	1480.	1.01	23.36	236	.02	.02	.01	345.
1.01	8.42	87	.08	.07	.01	1481.	1.01	23.42	237	.02	.02	.01	345.
1.01	8.48	88	.08	.07	.01	1481.	1.01	23.48	238	.02	.02	.01	345.
1.01	8.54	89	.08	.07	.01	1482.	1.01	23.54	239	.02	.02	.01	345.
1.01	9.00	90	.08	.07	.01	1482.	1.02	0.00	240	.02	.02	.01	345.
1.01	9.06	91	.08	.07	.01	1482.	1.02	.06	241	0.00	0.00	0.00	345.
1.01	9.12	92	.08	.07	.01	1482.	1.02	.12	242	0.00	0.00	0.00	343.
1.01	9.18	93	.08	.07	.01	1482.	1.02	.18	243	0.00	0.00	0.00	333.
1.01	9.24	94	.08	.07	.01	1482.	1.02	.24	244	0.00	0.00	0.00	313.
1.01	9.30	95	.08	.07	.01	1482.	1.02	.30	245	0.00	0.00	0.00	278.
1.01	9.36	96	.08	.07	.01	1482.	1.02	.36	246	0.00	0.00	0.00	235.
1.01	9.42	97	.08	.07	.01	1482.	1.02	.42	247	0.00	0.00	0.00	190.
1.01	9.48	98	.08	.07	.01	1482.	1.02	.48	248	0.00	0.00	0.00	150.
1.01	9.54	99	.08	.07	.01	1482.	1.02	.54	249	0.00	0.00	0.00	116.
1.01	10.00	100	.08	.07	.01	1482.	1.02	1.00	250	0.00	0.00	0.00	90.
1.01	10.06	101	.08	.07	.01	1482.	1.02	1.06	251	0.00	0.00	0.00	69.
1.01	10.12	102	.08	.07	.01	1482.	1.02	1.12	252	0.00	0.00	0.00	53.
1.01	10.18	103	.08	.07	.01	1482.	1.02	1.18	253	0.00	0.00	0.00	41.
1.01	10.24	104	.08	.07	.01	1482.	1.02	1.24	254	0.00	0.00	0.00	32.
1.01	10.30	105	.08	.07	.01	1482.	1.02	1.30	255	0.00	0.00	0.00	24.
1.01	10.36	106	.08	.07	.01	1482.	1.02	1.36	256	0.00	0.00	0.00	19.
1.01	10.42	107	.08	.07	.01	1482.	1.02	1.42	257	0.00	0.00	0.00	14.
1.01	10.48	108	.08	.07	.01	1482.	1.02	1.48	258	0.00	0.00	0.00	11.
1.01	10.54	109	.08	.07	.01	1482.	1.02	1.54	259	0.00	0.00	0.00	8.
1.01	11.00	110	.08	.07	.01	1482.	1.02	2.00	260	0.00	0.00	0.00	6.
1.01	11.06	111	.08	.07	.01	1482.	1.02	2.06	261	0.00	0.00	0.00	5.
1.01	11.12	112	.08	.07	.01	1482.	1.02	2.12	262	0.00	0.00	0.00	3.
1.01	11.18	113	.08	.07	.01	1482.	1.02	2.18	263	0.00	0.00	0.00	2.
1.01	11.24	114	.08	.07	.01	1482.	1.02	2.24	264	0.00	0.00	0.00	1.
1.01	11.30	115	.08	.07	.01	1482.	1.02	2.30	265	0.00	0.00	0.00	1.
1.01	11.36	116	.08	.07	.01	1482.	1.02	2.36	266	0.00	0.00	0.00	1.
1.01	11.42	117	.08	.07	.01	1482.	1.02	2.42	267	0.00	0.00	0.00	0.
1.01	11.48	118	.08	.07	.01	1482.	1.02	2.48	268	0.00	0.00	0.00	0.
1.01	11.54	119	.08	.07	.01	1482.	1.02	2.54	269	0.00	0.00	0.00	0.
1.01	12.00	120	.08	.07	.01	1482.	1.02	3.00	270	0.00	0.00	0.00	0.

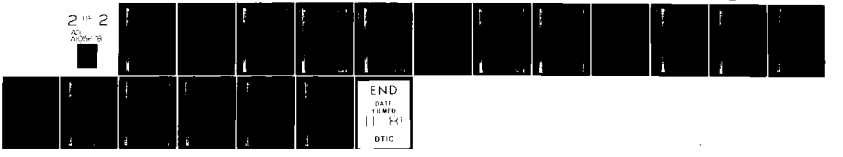
1.01	12.16	121	.24	.23	.01	1882.	1.02	5.76	271	0.00	0.00	0.00	0.
1.01	12.12	122	.24	.23	.01	1503.	1.02	5.12	272	0.00	0.00	0.00	0.
1.01	12.18	123	.24	.23	.01	1581.	1.02	5.18	273	0.00	0.00	0.00	0.
1.01	12.24	124	.24	.23	.01	1783.	1.02	5.24	274	0.00	0.00	0.00	0.
1.01	12.30	125	.24	.23	.01	2110.	1.02	5.30	275	0.00	0.00	0.00	0.
1.01	12.36	126	.24	.23	.01	2515.	1.02	5.36	276	0.00	0.00	0.00	0.
1.01	12.42	127	.24	.23	.01	2940.	1.02	5.42	277	0.00	0.00	0.00	0.
1.01	12.48	128	.24	.23	.01	3321.	1.02	5.48	278	0.00	0.00	0.00	0.
1.01	12.54	129	.24	.23	.01	3637.	1.02	5.54	279	0.00	0.00	0.00	0.
1.01	13.00	130	.24	.23	.01	3885.	1.02	6.00	280	0.00	0.00	0.00	0.
1.01	13.06	131	.29	.28	.01	4079.	1.02	6.06	281	0.00	0.00	0.00	0.
1.01	13.12	132	.29	.28	.01	4234.	1.02	6.12	282	0.00	0.00	0.00	0.
1.01	13.18	133	.29	.28	.01	4376.	1.02	6.18	283	0.00	0.00	0.00	0.
1.01	13.24	134	.29	.28	.01	4522.	1.02	6.24	284	0.00	0.00	0.00	0.
1.01	13.30	135	.29	.28	.01	4688.	1.02	6.30	285	0.00	0.00	0.00	0.
1.01	13.36	136	.29	.28	.01	4862.	1.02	6.36	286	0.00	0.00	0.00	0.
1.01	13.42	137	.29	.28	.01	5031.	1.02	6.42	287	0.00	0.00	0.00	0.
1.01	13.48	138	.29	.28	.01	5177.	1.02	6.48	288	0.00	0.00	0.00	0.
1.01	13.54	139	.29	.28	.01	5298.	1.02	6.54	289	0.00	0.00	0.00	0.
1.01	14.00	140	.29	.28	.01	5392.	1.02	7.00	290	0.00	0.00	0.00	0.
1.01	14.06	141	.36	.35	.01	5466.	1.02	7.06	291	0.00	0.00	0.00	0.
1.01	14.12	142	.36	.35	.01	5534.	1.02	7.12	292	0.00	0.00	0.00	0.
1.01	14.18	143	.36	.35	.01	5617.	1.02	7.18	293	0.00	0.00	0.00	0.
1.01	14.24	144	.36	.35	.01	5737.	1.02	7.24	294	0.00	0.00	0.00	0.
1.01	14.30	145	.36	.35	.01	5909.	1.02	7.30	295	0.00	0.00	0.00	0.
1.01	14.36	146	.36	.35	.01	6110.	1.02	7.36	296	0.00	0.00	0.00	0.
1.01	14.42	147	.36	.35	.01	6317.	1.02	7.42	297	0.00	0.00	0.00	0.
1.01	14.48	148	.36	.35	.01	6499.	1.02	7.48	298	0.00	0.00	0.00	0.
1.01	14.54	149	.36	.35	.01	6650.	1.02	7.54	299	0.00	0.00	0.00	0.
1.01	15.00	150	.36	.35	.01	6768.	1.02	8.00	300	0.00	0.00	0.00	0.
									SUM	31.20	29.0	2.16	989499.
										[792.1	[738.1	[55.3	(16692.75)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	20410.	7777.	2456.	1965.	589892.
CMS	578.	220.	70.	56.	16693.
INCHES		23.11	29.20	29.20	29.20
MM		587.04	741.66	741.66	741.66
AC-FT		3856.	4872.	4872.	4872.
THOUS CU M		4757.	6009.	6009.	6009.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 1

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	1.	6.	16.	33.	55.	79.	
101.	128.	177.	265.	405.	573.	769.	985.	1199.	1396.	
1216.	1277.	1324.	1360.	1388.	1410.	1427.	1440.	1450.	1458.	
1465.	1470.	1474.	1477.	1479.	1480.	1481.	1481.	1482.	1482.	
1482.	1482.	1482.	1482.	1482.	1482.	1482.	1482.	1482.	1482.	
1482.	1482.	1482.	1482.	1482.	1482.	1482.	1482.	1482.	1482.	
1482.	1482.	1482.								

AD-A105 678 PRC CONSOER TOWNSEND INC ST LOUIS MO F/G 13/13
NATIONAL DAM SAFETY PROGRAM. HENRY SEVER DAM (MO 10110), MISSIS--ETC(U)
DEC 78 DACW43-78-C-0160
UNCLASSIFIED NL



6860.	6932.	7001.	7111.	7337.	7893.	9235.	11632.	14839.	18105.
20053.	20410.	19263.	17809.	15359.	13545.	12019.	10780.	9852.	9133.
8570.	8152.	7788.	7458.	7112.	6780.	6466.	6188.	5957.	5771.
5630.	5493.	5280.	4926.	4387.	3751.	3092.	2505.	2018.	1637.
1340.	1108.	934.	798.	693.	614.	550.	501.	463.	433.
409.	389.	375.	364.	357.	352.	349.	346.	345.	345.
345.	345.	345.	345.	345.	345.	345.	345.	345.	345.
345.	345.	345.	345.	345.	345.	345.	345.	345.	345.
345.	345.	345.	345.	345.	345.	345.	345.	345.	345.
345.	343.	333.	313.	278.	235.	190.	150.	116.	90.
69.	53.	41.	32.	24.	19.	14.	11.	8.	6.
5.	3.	2.	1.	1.	1.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	20410.	7777.	2456.	1965.	589492.
CMS	578.	220.	70.	56.	16693.
INCHES		23.11	29.20	29.20	29.20
MM		587.04	741.66	741.66	741.66
AC-FT		3856.	4872.	4872.	4872.
THOUS CU M		4757.	6009.	6009.	6009.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 2

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	1.	3.	8.	17.	28.	40.
50.	64.	89.	133.	202.	287.	374.	452.	517.	568.
608.	639.	662.	680.	694.	705.	713.	720.	725.	729.
732.	735.	737.	738.	739.	740.	740.	741.	741.	741.
741.	741.	741.	741.	741.	741.	741.	741.	741.	741.
741.	741.	741.	741.	741.	741.	741.	741.	741.	741.
741.	741.	741.	741.	741.	741.	741.	741.	741.	741.
741.	752.	796.	892.	1055.	1257.	1470.	1660.	1819.	1943.
2040.	2118.	2188.	2261.	2348.	2431.	2515.	2589.	2649.	2696.
2735.	2767.	2809.	2869.	2955.	3055.	3158.	3250.	3325.	3384.
3430.	3466.	3500.	3555.	3669.	3946.	4617.	5816.	7419.	9052.
10027.	10205.	9632.	8705.	7679.	6773.	6009.	5390.	4926.	4566.
4289.	4076.	3892.	3727.	3556.	3390.	3233.	3094.	2979.	2885.
2815.	2747.	2680.	2463.	2194.	1875.	1546.	1253.	1009.	819.
670.	554.	467.	399.	347.	307.	275.	251.	231.	216.
204.	195.	188.	182.	179.	176.	174.	173.	173.	173.
173.	173.	173.	173.	173.	173.	173.	173.	173.	173.
173.	173.	173.	173.	173.	173.	173.	173.	173.	173.
173.	173.	173.	173.	173.	173.	173.	173.	173.	173.
173.	171.	167.	157.	139.	118.	95.	75.	58.	45.
35.	27.	21.	16.	12.	9.	7.	6.	4.	3.
2.	2.	1.	1.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	10205.	3886.	1228.	982.	294746.

PMF FLOOD ROUTING

CMS	289.	110.	55.	28.	8346.	
INCHES		11.56	14.60	14.60	14.60	
MM		293.52	370.83	370.83	370.83	
AC-FT		1928.	2436.	2436.	2436.	
THOUS CU M		2378.	3005.	3005.	3005.	

HYDROGRAPH ROUTING

ROUTE HYDROGRAPH THROUGH HENRY SEVER DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	1	0	0	2	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-683.	-1

STAGE	683.0	684.0	685.0	686.5	687.9	689.3	690.8	692.2
FLOW	0.	94.	281.	1214.	2696.	8472.	20519.	35069.
CAPACITY=	2106.	3001.	4000.	5533.	12893.			
ELEVATION=	683.	688.	693.	700.	720.			

CREL	SPWID	COOW	EXPW	ELEVL	COOL	CAREA	EXPL
683.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
688.0	0.0	0.0	0.

STATION 1, PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	1.
1.	2.	2.	3.	5.	7.	9.	13.	17.	22.
27.	32.	38.	43.	49.	55.	61.	67.	73.	79.
85.	91.	99.	111.	123.	138.	146.	157.	169.	180.
191.	202.	213.	224.	235.	246.	256.	267.	277.	288.
297.	370.	402.	433.	463.	492.	521.	548.	575.	601.
626.	651.	675.	698.	720.	742.	763.	784.	804.	824.
842.	861.	881.	904.	932.	973.	1024.	1084.	1153.	1236.
1383.	1493.	1624.	1755.	1887.	2021.	2157.	2294.	2430.	2565.
2706.	3214.	3618.	3965.	4280.	4574.	4852.	5116.	5363.	5592.
5788.	5968.	6152.	6305.	6461.	6657.	6986.	7569.	8527.	10478.

12910.	14981.	16354.	16914.	16764.	16111.	15171.	14105.	13035.	12034.
11134.	10349.	9676.	9094.	8739.	8436.	8129.	7824.	7527.	7245.
6984.	6743.	6513.	6274.	6000.	5672.	5290.	4867.	4425.	3984.
3561.	3184.	2774.	2627.	2539.	2452.	2365.	2280.	2196.	2115.
2037.	1961.	1888.	1817.	1750.	1685.	1623.	1564.	1507.	1453.
1402.	1353.	1306.	1262.	1219.	1192.	1168.	1144.	1121.	1099.
1077.	1056.	1036.	1016.	997.	978.	960.	942.	925.	909.
892.	877.	861.	847.	832.	818.	805.	792.	779.	766.
754.	742.	731.	719.	707.	694.	680.	666.	650.	635.
619.	603.	587.	571.	555.	540.	525.	510.	496.	482.
468.	455.	442.	429.	417.	405.	394.	382.	371.	361.
350.	340.	330.	321.	312.	303.	294.	286.	280.	278.
275.	273.	270.	268.	266.	264.	261.	259.	257.	255.
252.	250.	248.	246.	244.	242.	240.	238.	236.	234.

STORAGE

2106.	2106.	2106.	2106.	2106.	2106.	2106.	2106.	2106.	2106.
2106.	2106.	2106.	2106.	2106.	2106.	2106.	2106.	2106.	2106.
2106.	2106.	2106.	2106.	2106.	2106.	2106.	2106.	2106.	2106.
2106.	2106.	2106.	2106.	2106.	2106.	2106.	2106.	2106.	2106.
2106.	2106.	2106.	2106.	2106.	2106.	2106.	2106.	2106.	2106.
2106.	2106.	2106.	2106.	2106.	2106.	2106.	2106.	2107.	2107.
2108.	2109.	2110.	2112.	2115.	2119.	2124.	2131.	2139.	2148.
2157.	2167.	2178.	2188.	2199.	2210.	2222.	2233.	2244.	2256.
2267.	2279.	2290.	2301.	2312.	2324.	2335.	2346.	2357.	2367.
2378.	2389.	2399.	2410.	2420.	2430.	2440.	2451.	2461.	2470.
2480.	2489.	2498.	2507.	2516.	2524.	2532.	2540.	2548.	2555.
2562.	2569.	2576.	2582.	2589.	2595.	2601.	2607.	2613.	2618.
2623.	2629.	2634.	2641.	2649.	2661.	2675.	2692.	2712.	2733.
2755.	2777.	2800.	2823.	2846.	2869.	2893.	2917.	2940.	2964.
2987.	3008.	3026.	3042.	3056.	3069.	3081.	3093.	3104.	3114.
3123.	3132.	3139.	3146.	3153.	3162.	3176.	3202.	3245.	3303.
3364.	3415.	3450.	3464.	3460.	3444.	3420.	3398.	3367.	3342.
3319.	3299.	3282.	3268.	3254.	3241.	3227.	3214.	3200.	3186.
3176.	3165.	3155.	3144.	3132.	3118.	3101.	3082.	3062.	3042.
3024.	3006.	2990.	2975.	2959.	2944.	2929.	2914.	2900.	2886.
2872.	2859.	2846.	2834.	2822.	2811.	2800.	2790.	2780.	2771.
2762.	2753.	2745.	2737.	2730.	2723.	2716.	2709.	2703.	2696.
2690.	2684.	2678.	2673.	2667.	2662.	2657.	2652.	2647.	2642.
2638.	2633.	2629.	2625.	2621.	2617.	2613.	2609.	2605.	2602.
2598.	2595.	2592.	2588.	2585.	2581.	2577.	2573.	2569.	2564.
2560.	2555.	2551.	2546.	2542.	2538.	2533.	2529.	2525.	2521.
2517.	2513.	2510.	2506.	2503.	2499.	2496.	2493.	2490.	2487.
2484.	2481.	2478.	2475.	2473.	2470.	2468.	2465.	2463.	2461.
2458.	2456.	2454.	2452.	2449.	2447.	2445.	2443.	2441.	2439.
2437.	2435.	2432.	2430.	2428.	2426.	2424.	2422.	2421.	2419.

STAGE

683.0	683.0	683.0	683.0	683.0	683.0	683.0	683.0	683.0	683.0
683.0	683.0	683.0	683.0	683.0	683.0	683.0	683.0	683.0	683.0
683.0	683.0	683.0	683.0	683.0	683.0	683.0	683.0	683.0	683.0
683.0	683.0	683.0	683.0	683.0	683.0	683.0	683.0	683.0	683.0
683.0	683.0	683.0	683.0	683.0	683.0	683.0	683.0	683.0	683.0
683.0	683.0	683.0	683.0	683.0	683.0	683.0	683.0	683.0	683.0
683.0	683.0	683.0	683.0	683.0	683.1	683.1	683.1	683.2	683.2
683.3	683.3	683.4	683.5	683.5	683.6	683.6	683.7	683.8	683.8
683.9	684.0	684.0	684.1	684.2	684.2	684.3	684.3	684.4	684.5
684.5	684.6	684.6	684.7	684.8	684.8	684.9	684.9	685.0	685.0
685.1	685.1	685.2	685.2	685.3	685.3	685.4	685.4	685.5	685.5
685.6	685.6	685.6	685.7	685.7	685.7	685.8	685.8	685.8	685.9

685.9	685.9	686.0	686.0	686.0	686.1	686.2	686.3	686.4	686.5
686.6	686.8	686.9	687.0	687.1	687.3	687.4	687.5	687.7	687.8
687.9	688.0	688.1	688.2	688.3	688.3	688.4	688.5	688.5	688.6
688.6	688.7	688.7	688.7	688.8	688.8	688.9	689.0	689.2	689.5
689.8	690.1	690.2	690.3	690.3	690.2	690.1	690.0	689.8	689.7
689.6	689.5	689.4	689.3	689.3	689.2	689.1	689.1	689.0	688.9
688.9	688.8	688.8	688.7	688.7	688.6	688.5	688.4	688.3	688.2
688.1	688.0	687.9	687.9	687.8	687.7	687.6	687.5	687.4	687.4
687.3	687.2	687.1	687.1	687.0	686.9	686.9	686.8	686.8	686.7
686.7	686.6	686.6	686.5	686.5	686.4	686.4	686.4	686.3	686.3
686.3	686.2	686.2	686.2	686.1	686.1	686.1	686.0	686.0	686.0
686.0	685.9	685.9	685.9	685.9	685.9	685.8	685.8	685.8	685.8
685.8	685.7	685.7	685.7	685.7	685.7	685.6	685.6	685.6	685.6
685.5	685.5	685.5	685.5	685.4	685.4	685.4	685.4	685.3	685.3
685.3	685.3	685.3	685.2	685.2	685.2	685.2	685.2	685.1	685.1
685.1	685.1	685.1	685.1	685.0	685.0	685.0	685.0	685.0	685.0
685.0	685.0	684.9	684.9	684.9	684.9	684.9	684.9	684.9	684.9
684.8	684.8	684.8	684.8	684.8	684.8	684.8	684.8	684.8	684.7

PEAK OUTFLOW IS 16914. AT TIME 16.40 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	16914.	7237.	2299.	1839.	551730.
CMS	479.	205.	65.	52.	15623.
INCHES		21.51	27.33	27.33	27.33
MM		546.32	694.15	694.15	694.15
AC-FT		3589.	4560.	4560.	4560.
THOUS CU M		4427.	5624.	5624.	5624.

MAXIMUM STORAGE = 3464.

ONE-HALF PMF FLOOD ROUTING

DVN

STATION 1, PLAN 1, RATIO 2

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1.	1.	1.	2.	2.	4.	5.	7.	9.	11.
13.	16.	19.	22.	24.	27.	30.	33.	36.	39.
42.	45.	48.	51.	54.	57.	60.	63.	66.	69.
72.	75.	78.	81.	84.	86.	89.	92.	95.	101.
106.	112.	117.	123.	128.	133.	139.	144.	149.	154.
159.	164.	169.	174.	179.	184.	188.	193.	198.	202.
207.	212.	217.	222.	228.	236.	246.	257.	270.	291.
340.	390.	440.	491.	543.	596.	650.	705.	760.	814.
869.	923.	976.	1030.	1084.	1139.	1195.	1277.	1370.	1463.
1553.	1641.	1726.	1810.	1894.	1982.	2089.	2234.	2437.	2739.
3923.	4974.	5813.	6382.	6689.	6780.	6714.	6542.	6308.	6043.
5768.	5499.	5242.	4999.	4769.	4549.	4339.	4139.	3952.	3779.
3621.	3479.	3345.	3211.	3061.	2871.	2686.	2626.	2557.	2481.
2400.	2317.	2233.	2150.	2067.	1987.	1908.	1832.	1758.	1687.
1618.	1553.	1489.	1429.	1371.	1315.	1263.	1213.	1163.	1114.
1126.	1098.	1072.	1046.	1021.	997.	973.	950.	928.	906.
885.	865.	845.	825.	807.	789.	771.	754.	737.	721.
705.	690.	675.	661.	647.	633.	620.	607.	594.	582.
571.	559.	548.	537.	526.	514.	503.	491.	478.	466.
454.	442.	430.	418.	406.	395.	384.	373.	363.	352.
342.	333.	323.	314.	305.	296.	288.	280.	278.	276.
273.	271.	269.	266.	264.	262.	260.	257.	255.	253.
251.	249.	246.	244.	242.	240.	238.	236.	234.	232.
230.	228.	226.	224.	222.	220.	218.	216.	215.	213.

STORAGE

2106.	2106.	2106.	2106.	2106.	2106.	2106.	2106.	2106.	2106.
2106.	2106.	2106.	2106.	2106.	2106.	2106.	2106.	2106.	2106.
2106.	2106.	2106.	2106.	2106.	2106.	2106.	2106.	2106.	2106.
2106.	2106.	2106.	2106.	2106.	2106.	2106.	2106.	2106.	2106.
2106.	2106.	2106.	2106.	2106.	2106.	2106.	2106.	2106.	2106.
2106.	2106.	2106.	2106.	2106.	2106.	2106.	2106.	2106.	2107.
2107.	2107.	2108.	2109.	2110.	2112.	2115.	2118.	2122.	2127.
2132.	2137.	2142.	2147.	2153.	2158.	2164.	2169.	2175.	2181.
2187.	2192.	2198.	2204.	2209.	2215.	2221.	2226.	2232.	2237.
2243.	2248.	2254.	2259.	2265.	2270.	2276.	2281.	2286.	2292.
2297.	2302.	2307.	2312.	2318.	2323.	2328.	2333.	2337.	2342.
2347.	2352.	2357.	2361.	2366.	2371.	2375.	2380.	2384.	2389.
2393.	2398.	2402.	2407.	2414.	2421.	2431.	2441.	2450.	2467.
2481.	2495.	2509.	2524.	2539.	2554.	2569.	2584.	2600.	2615.
2631.	2646.	2661.	2677.	2692.	2708.	2724.	2740.	2756.	2772.
2788.	2803.	2818.	2833.	2847.	2863.	2881.	2906.	2942.	2988.
3040.	3087.	3124.	3149.	3163.	3167.	3164.	3156.	3146.	3134.
3122.	3110.	3098.	3088.	3077.	3068.	3058.	3049.	3041.	3033.
3026.	3020.	3014.	3008.	3001.	2994.	2985.	2975.	2963.	2949.
2939.	2921.	2906.	2892.	2877.	2863.	2850.	2836.	2824.	2811.
2799.	2788.	2777.	2766.	2756.	2747.	2737.	2729.	2720.	2712.

2704.	2696.	2689.	2681.	2674.	2667.	2661.	2654.	2648.	2641.
2636.	2630.	2624.	2619.	2613.	2608.	2603.	2598.	2593.	2589.
2584.	2580.	2576.	2572.	2568.	2564.	2560.	2557.	2553.	2550.
2546.	2543.	2540.	2537.	2533.	2530.	2527.	2524.	2520.	2517.
2513.	2510.	2506.	2503.	2500.	2496.	2493.	2490.	2487.	2484.
2481.	2479.	2476.	2473.	2471.	2468.	2466.	2464.	2461.	2459.
2457.	2454.	2452.	2450.	2448.	2446.	2443.	2441.	2439.	2437.
2435.	2433.	2431.	2429.	2427.	2425.	2423.	2421.	2419.	2417.
2415.	2413.	2411.	2410.	2408.	2406.	2404.	2402.	2400.	2399.

STAGE

683.0	683.0	683.0	683.0	683.0	683.0	683.0	683.0	683.0	683.0
683.0	683.0	683.0	683.0	683.0	683.0	683.0	683.0	683.0	683.0
683.0	683.0	683.0	683.0	683.0	683.0	683.0	683.0	683.0	683.0
683.0	683.0	683.0	683.0	683.0	683.0	683.0	683.0	683.0	683.0
683.0	683.0	683.0	683.0	683.0	683.0	683.0	683.0	683.0	683.0
683.0	683.0	683.0	683.0	683.0	683.0	683.0	683.0	683.0	683.0
683.0	683.0	683.0	683.0	683.0	683.0	683.1	683.1	683.1	683.1
683.1	683.2	683.2	683.2	683.3	683.3	683.3	683.4	683.4	683.4
683.5	683.5	683.5	683.5	683.6	683.6	683.6	683.7	683.7	683.7
683.8	683.8	683.8	683.9	683.9	683.9	683.9	684.0	684.0	684.0
684.1	684.1	684.1	684.2	684.2	684.2	684.2	684.3	684.3	684.3
684.3	684.4	684.4	684.4	684.5	684.5	684.5	684.5	684.6	684.6
684.6	684.6	684.7	684.7	684.7	684.8	684.8	684.9	684.9	685.0
685.1	685.2	685.3	685.3	685.4	685.5	685.6	685.7	685.8	685.8
685.9	686.0	686.1	686.2	686.3	686.4	686.5	686.5	686.6	686.7
686.8	686.9	687.0	687.1	687.1	687.2	687.3	687.5	687.7	687.9
688.2	688.4	688.6	688.7	688.8	688.8	688.8	688.8	688.7	688.7
688.6	688.5	688.5	688.4	688.4	688.3	688.3	688.2	688.2	688.2
688.1	688.1	688.1	688.0	688.0	688.0	687.9	687.9	687.8	687.7
687.6	687.6	687.5	687.4	687.3	687.2	687.2	687.1	687.0	686.9
686.9	686.8	686.7	686.7	686.6	686.6	686.5	686.5	686.4	686.4
686.3	686.3	686.3	686.2	686.2	686.1	686.1	686.1	686.0	686.0
686.0	685.9	685.9	685.9	685.8	685.8	685.8	685.7	685.7	685.7
685.7	685.6	685.6	685.6	685.6	685.6	685.5	685.5	685.5	685.5
685.5	685.4	685.4	685.4	685.4	685.4	685.4	685.3	685.3	685.3
685.3	685.3	685.2	685.2	685.2	685.2	685.2	685.1	685.1	685.1
685.1	685.1	685.1	685.1	685.0	685.0	685.0	685.0	685.0	685.0
685.0	684.9	684.9	684.9	684.9	684.9	684.9	684.9	684.9	684.8
684.8	684.8	684.8	684.8	684.8	684.8	684.8	684.8	684.7	684.7
684.7	684.7	684.7	684.7	684.7	684.7	684.7	684.7	684.6	684.6

PEAK OUTFLOW IS 6780. AT TIME 16.60 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6780.	3195.	1081.	865.	259366.
CMS	192.	90.	31.	24.	7344.
INCHES		9.50	12.85	12.85	12.85
MM		241.19	326.32	326.32	326.32
AC-FT		1584.	2144.	2144.	2144.
THOUS CU M		1954.	2644.	2644.	2644.

MAXIMUM STORAGE = 3167.

SUMMARY OF PMF AND ONE-HALF PMF FLOOD ROUTING

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 1.00	RATIO 2 .50
HYDROGRAPH AT	1	3.13	1	20410.	10205.
	(	8.11)	(	577.95)(	288.97)(
ROUTED TO	1	3.13	1	16914.	6780.
	(	8.11)	(	478.95)(	191.99)(

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	683.00	683.00	688.00
STORAGE	2106.	2106.	3001.
OUTFLOW	0.	0.	3055.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	690.32	2.32	3464.	16914.	5.10	16.40	0.00
.50	688.83	.83	3167.	6780.	2.50	16.60	0.00

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**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  3 AUG 78
**********
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PERCENT OF PMF FLOOD ROUTING
EQUAL TO SPILLWAY CAPACITY

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT 1
ROUTE HYDROGRAPH TO 1
END OF NETWORK

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**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION  JULY 1978
 LAST MODIFICATION  3 AUG 78
**********

RUN  DATE= 78/10/26.
     TIME= 07.58.27.
```

DAM SAFETY INSPECTION - MISSOURI
HENRY SEVER DAM
PERCENT OF PMF DETERMINATION AND ROUTING

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	6	0	0	0	0	0	4	0

JOPER	NRT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 9 LRTIO= 1

RTIOS=	.32	.34	.36	.38	.40	.42	.44	.46	.48

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INPUT PMP INDEX PRECIPITATION AND RATIOS, INPUT SCS UNI

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUNG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	-1	3.13	0.00	3.13	1.00	0.000	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	24.00	100.00	120.00	130.00	0.00	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	.85	.07	0.00	0.00

RECESSION DATA

STRTQ= 0.00 QRCSN= 0.00 RTIOR= 1.00

	END-OF-PERIOD FLOW									
MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	31.20	29.08	2.16	589899.
										(792.1	(738.)	(55.)	(16698.79)

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE HYDROGRAPH THROUGH HENRY SEVER DAM

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-683.	-1

STAGE	683.0	684.0	685.(	686.5	687.9	689.3	690.8	692.2
FLOW	0.	94.	281.	1214.	2696.	8972.	20519.	35069.
CAPACITY=	2106.	3001.	4000.	5553.	12893.			
ELEVATION=	683.	688.	693.	700.	720.			

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
683.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
688.0	0.0	0.0	0.

PEAK OUTFLOW IS 2585. AT TIME 17.20 HOURS

PEAK OUTFLOW IS 3021. AT TIME 17.00 HOURS

PEAK OUTFLOW IS 3563. AT TIME 16.90 HOURS

PEAK OUTFLOW IS 4062. AT TIME 16.80 HOURS

PEAK OUTFLOW IS 4541. AT TIME 16.80 HOURS

PEAK OUTFLOW IS 5023. AT TIME 16.70 HOURS

PEAK OUTFLOW IS 5470. AT TIME 16.70 HOURS

PEAK OUTFLOW IS 5912. AT TIME 16.60 HOURS

PEAK OUTFLOW IS 6367. AT TIME 16.60 HOURS

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PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIO 1 .32	RATIO 2 .34	RATIO 3 .36	RATIO 4 .38	RATIO 5 .40	RATIO 6 .42	RATIO 7 .44	RATIO 8 .46	RATIO 9 .48
HYDROGRAPH AT	1	3.13	1	6531.	6939.	7348.	7756.	8164.	8572.	8980.	9389.	9797.
	(	8.11)	(	184.94)(	196.50)(	208.06)(	219.62)(	231.18)(	242.74)(	254.30)(	265.86)(	277.42)
ROUTED TO	1	3.13	1	2585.	3021.	3564.	4042.	4541.	5023.	5470.	5912.	6347.
	(	8.11)	(	73.21)(	85.55)(	100.91)(	114.43)(	128.59)(	142.23)(	154.88)(	167.41)(	179.74)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	683.00	693.00	698.00
STORAGE	2100.	2100.	3001.
OUTFLOW	0.	0.	3055.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.32	687.81	0.00	2967.	2585.	0.00	17.20	0.00
.34	687.99	0.00	3000.	3021.	0.00	17.00	0.00
.36	688.11	.11	3024.	3563.	1.00	16.90	0.00
.38	688.22	.22	3046.	4062.	1.00	16.80	0.00
.40	688.33	.33	3067.	4541.	1.00	16.80	0.00
.42	688.44	.44	3089.	5023.	1.80	16.70	0.00
.44	688.54	.54	3109.	5470.	2.00	16.70	0.00
.46	688.64	.64	3128.	5912.	2.20	16.60	0.00
.48	688.73	.73	3148.	6347.	2.40	16.60	0.00

DATE
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